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SELECTED WATER RESOURCES ABSTRACTS

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AUGUST 15, 1981

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U.S. Department of the Interior

VOLUME 14, NUMBER 16
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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

ECOLOGICAL CHARACTERIZATION OF THE SEA ISLAND COASTAL REGION OF SOUTH CAROLINA AND GEORGIA; EXECUTIVE SUMMARY,
South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Div.
M. D. McKenzie, and L. A. Barclay.
Available from Supt. of Documents, GPO, Washington, DC 20402, Stock No 024-010-00590-4. Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-79/45, December, 1980. 58 p, 33 Fig, 7 Tab, 2 Ref. 14-16-0009-77-016.

Descriptors: *Coasts, *Ecology, *Environmental effects, *Wildlife, Social aspects, Economic aspects, Baseline studies, Model studies, Food chains, Fish, Habitats, *Sea Island area, South Carolina, Georgia.

The Sea Island Coastal Region of South Carolina and Georgia is rich in natural resources, including moderate climate, dramatic scenic qualities, fertile soils, water, fish, wildlife and minerals. This ecological characterization is designed to yield products that will assist decisionmakers in evaluating and predicting impacts of man-induced perturbations (such as water resource projects), and, in general, coastal zone planning. The study identifies critical habitats and sensitive life history stages of important species, addresses functional interactions at the habitat level, and provides socioeconomic information relative to the coastal environment. To accommodate the broadest range of potential users, a three-tier conceptual model presentation is used and includes the following elements for each ecosystem: a technical energese model demonstrating energy flow; a less technical pictoral model of the same ecosystem illustrating representative flora and fauna; and a representative food web indicating trophodynamics within the subject ecosystem. The seven major ecosystems found in the Sea Island Coastal Region are: coastal marine, maritime, estuarine, riverine, lacustrine, palustrine and upland. Biological components of these seven ecosystems are extremely diverse and complex. Of particular importance to the socioeconomic base of the coastal area is the fact that individuals, populations, and communities are not static entitles; they change in direction, influenced at least partly by their history and environment. (Moore-SRC)
W81-03313

ECOLOGICAL CHARACTERIZATION OF THE SEA ISLAND COASTAL REGION OF SOUTH CAROLINA AND GEORGIA; VOLUME I; PHYSICAL FEATURES OF THE CHARACTERIZATION AREA.
South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Div.
Available from Supt. of Documents, GPO, Washington, DC 20402, Stock No 024-010-00590-4. Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-79/40, December, 1980. 230 p, 61 Fig, 38 Tab, 219 Ref, 4 Append. 14-16-0009-77-016.

Descriptors: *Coasts, *Resources management, Climatic data, Geology, Hydrology, Erosion, Physiographic provinces, Baseline studies, Ecology, Environmental effects, Groundwater, Water use, *Physical analysis, *Sea Island area, South Carolina, Georgia.

A significant trend in the management and development of coastal resources is the growing realization that rational decisions and final judgements can be made only when all available information on local environmental conditions is considered. As part of ecological characterization of the Sea Island Coastal Region, detailed information is provided for physical features such as climate, physiography, geologic history, geologic structure, coastal and nearshore erosion and deposition, hydrology, and descriptions of individual coastal islands. Whenever possible, historical data have been included for comparison with current data or to illustrate long-term trends. Future plans for development have also been included. Groundwater may well be the most important mineral resource in the Sea Island Coastal Region; approximately 1.44 x 10 to the 9th power 1/day are being pumped for municipal and industrial use. The depth of the water table and drainage characteristics are particularly important in determining the value and vulnerability of Sea Island Coast Region soils to potential uses by man. The whole region is quite complicated with respect to geology chemistry, and ecology. Man-induced alterations have further complicated the situation, with significant environmental impact. These man-made coastal alterations in the region are related primarily to: agriculture; dredging and filling; dune destruction; water utilization for effluent discharge, power generation, and related water development projects; insect control activities; upstream activities; and recreation. (Moore-SRC)
W81-03314

ECOLOGICAL CHARACTERIZATION OF THE SEA ISLAND COASTAL REGION OF SOUTH CAROLINA AND GEORGIA; VOLUME II; SOCIOECONOMIC FEATURES OF THE CHARACTERIZATION AREA.
South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Div.
Available from Supt. of Documents, GPO, Washington, DC 20402, Stock No 024-010-00590-4. Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-79/41, December, 1980. 345 p, 36 Fig, 180 Tab, 390 Ref. 14-16-0009-77-016.

Descriptors: *Coasts, *Social aspects, *Economic aspects, *Natural resources, Environment, Agriculture, Wildlife, Urbanization, Energy, Water resources development, Recreation, Industrial development, Transportation, Utilities, *Sea Island area, South Carolina, Georgia.

There are a number of socioeconomic changes occurring simultaneously in the Sea Island Coastal Region of South Carolina and Georgia. Although it is difficult to isolate the effects of any single changing force, it is likely that they are all closely interrelated in producing new demands on natural resources of the study area. Basically, the Sea Island Coastal Region has developed over the last three centuries into an ecosystem that is strongly influenced by agriculture, urbanization, and natural factors. The natural system, composed of seven major ecosystems and a combination of energy sources, directly influences the agricultural and urban systems through a flow of natural resources, such as land, water, and oxygen. Natural resources are needed by the socioeconomic environment for nutrient exchange, biological diversity, habitat maintenance, wildlife productivity, and environment quality. Data are presented on population, labor force characteristics and trends, transportation, industrial development, agricultural practices, public utilities, energy resources, fish and wildlife conservation and utilization, and recreational resources. The information provided may be useful to public decision makers, planners, field biologists and other citizens in formulating coastal resource management strategies. (Moore-SRC)
W81-03315

ECOLOGICAL CHARACTERIZATION OF THE SEA ISLAND COASTAL REGION OF SOUTH CAROLINA AND GEORGIA; VOLUME III; BIOLOGICAL FEATURES OF THE CHARACTERIZATION AREA.
South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Div.
Available from Supt. of Documents, GPO, Washington, DC 20402, Stock No 024-010-00590-4. Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-79/42, December, 1980. 645 p, 85 Fig, 155 Tab, 1400 Ref, Append. 14-16-0009-77-016.

Descriptors: *Coasts, *Ecosystems, *Resources management, *Environmental effects, Ecology, Wildlife, Habitats, Model studies, Animal populations, Plant populations, Aquatic environment, Estuarine environment, Baseline studies, *Sea Island area, South Carolina, Georgia.

Recognition of the need for an ecological approach in managing coastal resources has developed from increasing evidence that man's utilization of this environment has brought about major, yet often subtle, changes in the functioning of ecosystems. These functional relationships must be understood in order to perpetuate the economic, aesthetic, and biological values of coastal ecosystems. This ecological characterization of the Sea Island Coastal Region of South Carolina and Georgia is at the macroecosystem level and is organized along both structural and functional lines. The study area includes the coastal tier of counties in South Carolina and Georgia and the adjacent lowland counties. The study area was divided into the following seven macroecosystems for characterization: coastal marine, maritime, estuarine, riverine, palustrine, lacustrine, and upland. Biotic components are described along ecological lines. This approach facilitates the treatment of major community or habitat types, and generally deals with organisms at the population level. Functional relationships and areas of ecological sensitivity are stressed. Because conceptual models are particularly valuable in identifying ecosystem components and in relating their functional significance and regulatory processes, exemplary models are provided. (Moore-SRC)
W81-03316

INSTITUTIONAL SUPPORT OF WATER RESOURCE MODELS,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 7C.
W81-03318

DETERMINATION OF LAND USE FROM SATELLITE IMAGERY FOR INPUT TO HYDROLOGIC MODELS,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 7B.
W81-03319

TRRL AND UNIT HYDROGRAPH SIMULATIONS COMPARED WITH MEASUREMENTS IN AN URBAN CATCHMENT,
Water Research Centre, Marlow (England).
D. W. Williams, R. J. Cameron, and G. P. Evans.
Journal of Hydrology, Vol 48, No 1/2, p 63-70, August, 1980. 4 Fig, 5 Ref.

Descriptors: *Model studies, *Rainfall-runoff relationships, *Hydrographs, *Urban runoff, Runoff, Storm runoff, Mathematical models.

The quantity of storm runoff from a sewered urban catchment was modeled using the Transport and Road Research Laboratory hydrograph method and the unit hydrograph method. Both methods produced simulated hydrographs which agreed well with the measured hydrograph for a test event, a rainfall of 26.8 mm within 9 hours, peak intensity 10.8 mm per hour. The peak was underestimated in both models by 26-30%, and flows at the start of the storm were over-estimated. (Cassar-FRC)
W81-03435

FLOOD HYDROGRAPH SIMULATION MODEL,
Macdonald Coll. Ste. Anne de Bellevue (Quebec). Dept. of Agricultural Engineering.
N. Foroud, and R. S. Broughton.
Journal of Hydrology, Vol 49, No 1/2, p 139-172, January, 1981. 20 Fig, 10 Tab, 25 Ref.

Descriptors: *Model studies, *Rainfall-runoff relationships, Hydrographs, Design flood, Basins, Watersheds, Storms, Rainfall, Runoff, Floods, *Flood hydrographs, Hydrology, Small watersheds, River basins, *Flood forecasting, Peak discharge, Flow.

A model for predicting the design flood hydrograph and peak discharge for small watersheds takes into account both basin and storm characteristics, such as variation or areal distribution of a moving rainstorm, rainfall duration, and time and spatial distribution of excess rainfall. The physical aspects of this model are expressed by dividing the

basin into isochronal subareas. Data from 39 storms in 4 subareas of the Yamaska River, Canada, were used to develop the model. It was tested on the Runnets watershed, not used in development of the model, and results were in good agreement with observed data. (Cassar-FRC)
W81-03437

2B. Precipitation

COASTAL-INLAND DISTRIBUTIONS OF SUMMER AIR TEMPERATURE AND PRECIPITATION IN NORTHERN ALASKA,
Cold Regions Research and Engineering Lab., Hanover, NH.
R. K. Haugen, and J. Brown.
Arctic and Alpine Research, Vol 12, No 4, p 403-412, November, 1980. 6 Fig, 3 Tab, 22 Ref.

Descriptors: *Precipitation, *Coastal plains, *Alaska, *Air temperature, *Summer, Temperature, Arctic, Cold regions, Tundra, Distribution patterns.

Although summer air temperatures measured during 1975-78 on the coast of the Alaskan Arctic Coastal Plain were less than inland temperatures (3.7C on the coast at Barrow vs. 8.7C 48 km from the coast), precipitation differences were less distinct. Inland precipitation may be slightly greater. However, the nature of precipitation is different between coastal and inland sites. Near the coast, trace precipitation (less than 0.005 in) occurs frequently, on about half the days for which precipitation is recorded. The measured summer precipitation should be increased by a factor of 1.1 to account for this trace precipitation, which is normally unreported. (Cassar-FRC)
W81-03461

2C. Snow, Ice, and Frost

THE EFFECT OF SNOW DRIFTING ON GAMMA SNOW SURVEY RESULTS,
Saskatchewan Dept. of the Environment, Regina.
For primary bibliographic entry see Field 7B.
W81-03432

HYDROLOGY OF A SMALL LAKE IN THE CANADIAN HIGH ARCTIC,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
M. K. Woo.
Arctic and Alpine Research, Vol 12, No 2, p 227-235, May, 1980. 9 Fig, 11 Ref.

Descriptors: *Permafrost, *Lakes, *Arctic, Snowmelt, Hydrologic budget, Ice, Evaporation, Runoff, Rainfall, Flow, Discharge, Ice jams, Melting, Canada, Hydrology, Cold regions.

The hydrologic processes acting upon a small lake, Three Mile Lake, in the continuous permafrost area of Northwest Territories in Arctic Canada were examined. This information has applications because lakes of this type sometimes provide water supply to northern communities and support fish and wildlife. The lake, surface area 0.2 sq km, has a maximum depth exceeding 10 meters with a 5 meter deep sill across the middle. The snowmelt period in July produces large lake level rises with enhanced lake ice disintegration because the outflow channel is blocked by snowdrifts. During the outflow breakup period, lasting for several days, the lake discharges over 75% of its annual outflow. The summer period occurs as ice cover disappears and evaporation becomes an important source of water loss. Rainfall and runoff from summer storms replenish evaporation losses. The winter period begins in September with ice formation on the lake surface. Ice cover reaches a maximum thickness of 2.4 meters. (Cassar-FRC)
W81-03459

THE SNOW COVER OF SEA ICE DURING THE ARCTIC ICE DYNAMICS JOINT EXPERIMENT, 1975 TO 1976,
A. M. Hanson.
Arctic and Alpine Research, Vol 12, No 2, p 215-226, May, 1980. 6 Fig, 6 Tab, 9 Ref.

Descriptors: *Snow surveys, *Ice, *Sea ice, Snow cover, Snowfall, Snowmelt, Analytical techniques, Arctic Ice Dynamics Joint Experiment, Sampling.

Snow depths were measured during the Arctic Ice Dynamics Joint Experiment on sea ice northeast of Point Barrow, Alaska, at 73-77 degrees latitude during 1975-76. In May 1975, the mean snow depth on ice floes varied from 0.20 to 0.28 meters. The mean snowfall for 1974-75 was calculated to be about 1.5 meters, of which 40% fell during the summer. Summer snowfall prolonged the melting of the initial snow cover. As snow melting progressed, ice was exposed, from 5% on June 21 to 90% by July 13. The 1975-76 snow season began in August 30 and reached 67% of its depth by the end of October. Snow depth measurements showed that the wind moved the snow from floes to rough ice, where snow depth was 50% greater. A sample most representative of a winter's snowfall accumulationis that taken near the center of a very large floe (one greater than 20 sq km). (Cassar-FRC)
W81-03460

2E. Streamflow and Runoff

MODELING SOIL WATER CONTENTS AND THEIR EFFECTS ON STREAM FLOW IN KENTUCKY,
Kentucky Water Resources Research Inst., Lexington.
For primary bibliographic entry see Field 2G.
W81-03260

INVESTIGATION OF SOIL CONSERVATION SERVICE URBAN HYDROLOGY TECHNIQUES,
Espey, Huston and Associates, Inc., Austin, TX.
D. G. Altman, W. H. Espey, Jr., and A. D. Feldman.
Hydrologic Engineering Center, Davis, California, Technical Paper No 77, May, 1980. 13 p, 5 Fig, 4 Tab, 18 Ref.

Descriptors: *Urban hydrology, *Urban runoff, *Mathematical studies, *Flood peak, *Runoff forecasting, Urban watersheds, Soil properties, Prediction, Urbanization, Discharge hydrographs.

Data and information are provided to improve understanding of the advantages and limitations of the Soil Conservation Service's (SCS) urban hydrologic techniques. Four watersheds, two urban and two undeveloped, were studied. For each watershed the SCS runoff curve numbers and hydrograph lag times were determined and the 'calculated' values compared with the 'optimized' values. These calculated and optimized values were used to generate synthetic peak discharge frequency curves, which were compared with annual series frequency curves. In four of the six watershed conditions studied the optimized curve numbers were greater than the calculated. There was considerable variability in the optimized values for both curve numbers and lag times. The undeveloped watersheds had greater proportions of soils with a high runoff potential. The frequency curves generated from the optimized values were higher than those generated from the calculated values. The SCS methods may provide relatively low peak discharge estimates, but these generalized techniques have potential in predicting effects of urbanization on flood discharges. (Brambley-SRC)
W81-03317

CORPS OF ENGINEERS' EXPERIENCE WITH AUTOMATIC CALIBRATION OF A PRECIPITATION-RUNOFF MODEL,
Army Corps of Engineers Hydrologic Engineering Center, Davis, CA.
D. T. Ford, E. C. Morris, and A. D. Feldman.
Technical Paper No 70, May, 1980. 10 p, 2 Fig, 3 Tab, 20 Ref.

Descriptors: *Rainfall-runoff relationships, *Computer models, Computer programs, Automation, *Model studies, Mathematical studies, Watershed management, Flood control, Channels, Reservoirs, Simulation.

To satisfy the need for a precipitation-runoff model for application in water resources planning and management, the computer program HEC-1 was developed. This model includes algorithms to accomplish the following tasks necessary to simulate watershed response: determine effective precipitation; compute the subarea runoff due to the effective precipitation; and route and combine the subarea runoff hydrographs. In addition, HEC-1 includes the capability to determine automatically the parameters of the functions employed in the simulation. This is accomplished using Newton's technique to minimize a weighted least-squares objective function. Currently, alternative optimization techniques and alternative objective functions are being evaluated. The parameter estimation capability of program HEC-1 has been employed in applications focused on modelling the impact of basin modifications, of channel improvements, of various flood control measures, and on developing frequency curves for ungaged watersheds. The parameter estimation technique of HEC-1 has been extended recently to update sequentially parameter estimates for flood forecasting. In these applications, computed reservoir inflows and observed mean areal precipitation available at the time of forecast are used to estimate model parameters. These parameters are used then to estimate future reservoir inflows, using the simulation capability of the program. The results of the applications are satisfactory for application to flood-control reservoir operation. (Brambley-SRC)
W81-03320

CURVATURE CORRECTIONS IN OPEN CHANNEL FLOW,
Concordia Univ., Montreal (Quebec). Dept. of Civil Engineering.
M. S. Nasser, P. Venkataraman, and A. S. Ramamurthy.
Canadian Journal of Civil Engineering, Vol 7, No 3, p 421-431, September, 1980. 12 Fig, 1 Tab, 8 Ref.

Descriptors: *Channel flow, *Mathematical studies, Curvilinear flow, Flow characteristics, Pressure head, Flow resistance, Conveyance structures, Water conveyance, Streams, *Channel morphology, Stress-strain curves.

Curvilinear flow in open channels was studied mathematically and in practice. The pressure head coefficient and pressure force coefficient used to account for curvature effects utilizing the energy approach and the momentum approach respectively are shown to be related by a simple expression: Force coefficient = 2 (pressure coefficient) - 1. Since the pressure force coefficient is readily obtained, the energy approach may be easily applied to curvilinear flow problems. Calculations were verified by experiments conducted on a simple bottom slot and for the case of a free overfall. (Cassar-FRC)
W81-03423

ON THE OCCURRENCE AND IMPORTANCE OF PARETIAN-TAILED DISTRIBUTIONS IN HYDROLOGY,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
I. D. Ochoa, M. C. Bryson, and H-W. Shen.
Journal of Hydrology, Vol 48, No 1/2, p 53-62, August, 1980. 4 Fig, 4 Tab, 6 Ref.

Descriptors: *Paretian tails, *Statistical studies, *Flood recurrence interval, Peak annual discharge, River forecasting, Flood frequency, Hydrology, Forecasting.

Type I and Type II extreme value distributions were used to compare the tail behavior of empirical flood data from gauging stations in the Southwest, California, the North-Central states, and the East. Type II provided a better fit in 286 of the 407 cases, suggesting that Paretian or heavy-tailed distributions occur very often. Graphs show that incorrect assumptions in tail behavior can lead to

enormous errors in estimating the frequency of occurrence of extreme events. Although it is unlikely that real flood data will be accurately modeled by either Type I or Type II, the 2 cases appear to represent reasonable upper and lower limits. (Cassar-FRC)
W81-03434

FLOOD HYDROGRAPH SIMULATION MODEL,
Macdonald Coll. Ste. Anne de Bellevue (Quebec). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2A.
W81-03437

APPLICATION OF ADVANCES IN FLOOD FREQUENCY ANALYSIS,
Pima County Dept. of Transportation; and Pima Flood Control District, Tucson, AZ.
B. M. Reich, and K. G. Renard.
Water Resources Bulletin, Vol 17, No 1, p 67-74, February, 1981. 10 Fig, 1 Tab, 23 Ref.

Descriptors: *Flood frequency, *Computer programs, *Design flood, Graphical analysis, Probability, Ephemeral streams, Flood forecasting, Hydrology, Model studies, Mathematical models, Hydrographs, Synthetic hydrology, Streams, Runoff, Forecasting.

Computer programs for flood frequency analysis are widely available. Serious errors can result from blindly accepting results of these methods. The authors advocate use of visual representation of floods on frequency paper with compatible scales. The Cunnane plotting position used in this paper is better than the Weibull equation, having a mathematically sound basis for locating observed floods on an assumed probability. Mathematical modeling can lead to serious errors in selecting a 100 year flood, whereas graphical display of observed flood series using different papers can select a probability distribution which allows extending relatively short flood series with a straight line to select a reasonable design storm. Graphical interpretations can also be useful in an evaluation of infrequent floods in ephemeral streams. (Cassar-FRC)
W81-03556

2F. Groundwater

HYDROGEOLOGIC DATA FROM NORTH-CENTRAL KANSAS,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-03278

AN ECONOMICAL APPROACH TO DETERMINING THE EXTENT OF GROUND-WATER CONTAMINATION AND FORMULATING A CONTAMINANT REMOVAL PLAN,
California State Dept. of Water Resources, Monterey Park.
For primary bibliographic entry see Field 5B.
W81-03409

FAULT CONTROLLED GROUND-WATER CIRCULATION UNDER THE COLORADO RIVER, MARBLE CANYON, ARIZONA,
Wyoming Univ., Laramie. Dept. of Geology.
P. W. Huntoon.
Ground Water, Vol 19, No 1, p 20-27, January/February, 1981. 6 Fig, 3 Tab, 11 Ref.

Descriptors: *Geologic fractures, *Groundwater movement, *Fault springs, Geology, *Colorado River, Marble Canyon, Arizona, Springs, Flow discharge, Hydrogeology, Fence fault, Water quality.

A study of springs discharging along both sides of the Colorado River in Marble Canyon, Arizona, between river miles 30 and 34.5 disclosed an unusual occurrence--some of the springs on the west bank discharged water originating east of the river. This was confirmed by chemical quality and temperature data. The waters originate in plateaus on each side of the canyon and are conducted to the floor of the canyon along the Fence fault zone and other fractures, which cross the river between miles 30 and 31. Although it is not expected that any hydraulic connection could exist between water on opposite sides of a river within a fault, analysis of ionic concentrations showed that water from the east of the river flows under the river in the Fence fault zone, where it mixes with water from the west side before discharging from springs on the west bank. (Cassar-FRC)
W81-03411

DEMARCATION OF FRESH- AND SALINE-WATER ZONES, USING ELECTRICAL METHODS (ABOHAR AREA, FEROZEPUR DISTRICT, PUNJAB),
Geological Survey of India, Calcutta.
C. L. Arora, and R. N. Bose.
Journal of Hydrology, Vol 49, No 1/2, p 75-86, January, 1981. 7 Fig, 5 Ref.

Descriptors: *Saline-freshwater interfaces, Freshwater, Percolation, *Groundwater, Resistivity, Exploration, Boundaries, Interfaces, Analytical techniques, *India, Canals, Seepage, Water wells, Groundwater availability, Water resources development, Water sources, Electrical equipment.

Electrical resistivity-depth probe surveys in the Abohar area, Ferozepur district, Punjab, revealed that bodies of freshwater have developed overlying the saline groundwater. The freshwater zones, which vary in thickness from a few meters to more than 80 meters, are generally located near canals and perennial tanks and in areas where coarser sediments predominate. The electromagnetic traverse method proved to be a fast reconnaissance technique to locate boundaries between fresh and saline water zones prior to quantitative measurements by the resistivity method. The area east southeast of the town of Abohar, with a 30 meter thick freshwater vein, appears to be a promising location for groundwater exploitation by tube wells. (Cassar-FRC)
W81-03436

GROUND WATER,
Geraghty and Miller, Inc., Syosset, NY.
N. P. Gillies, and O. C. Braids.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1528-1533, June, 1980. 40 Ref.

Descriptors: *Groundwater movement, *Path of pollutants, *Water pollution sources, Aquifers, Model studies, Injection wells, Reviews, Landfills, Leachates, Diseases, Wells.

A review of literature on groundwater includes studies on groundwater movement, mathematical models for simulating movement of contaminants, case studies of groundwater pollution from landfill leachates and agricultural sources, pressure buildup in injection wells, waterborne disease caused by contaminated groundwater, the value of three different leaching tests, heat dissipation, and aquifer assessment. (Cassar-FRC)
W81-03487

AQUIFER MODELS OF PRESSURE DRAWDOWN IN THE WAIRAKEI-TAUHARA GEOTHERMAL REGION,
Department of Scientific and Industrial Research, Wellington (New Zealand). Applied Mathematics Div.
R. A. Wooding.
Water Resources Research, Vol 17, No 1, p 83-92, February, 1981. 7 Fig, 6 Tab, 41 Ref.

Descriptors: *Aquifers, *Geothermal studies, *Drawdown, Pressure head, Wairakei, Tauhara, *New Zealand, Geophysics, Model studies, Groundwater movement, Permeability.

Two models were applied to the pressure response of the Tauhara geothermal field to drawdown from the Wairakei field. Both models shared some features: a steady horizontal ouflow from Wairakei, arising from natural convection and present before development, and a superimposed downward pressure gradient, a consequence of the efficient horizontal propagation of the pressure drawdown at Wairakei. The second model produced the best fit to field pressure data. It had impermeable upper and lower boundaries. The only barrier to horizontal flow was a straight boundary to the southeast of the Tauhara field. Observation wells were located within 10 km of Wairakei but outside the production bore field. (Cassar-FRC)
W81-03550

2G. Water In Soils

MODELING SOIL WATER CONTENTS AND THEIR EFFECTS ON STREAM FLOW IN KENTUCKY,
Kentucky Water Resources Research Inst., Lexington.
G. W. Thomas, R. E. Phillips, D. E. Radcliffe, and S. Shepard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209231, Price codes: A05 in paper copy, A01 in microfiche. Research Report No 128, 1981. 73 p, 16 Fig, 9 Tab, 8 Ref. OWRT-A-073-KY(1), 14-34-0001-0119.

Descriptors: *Soil water, *Soil types, Soil porosity, Soil profiles, Soil water table, *Soil moisture retention, Subsurface water, *Flow resistance, Streamflow, *Runoff forecasting, Model studies, Kentucky.

Soil water contents of eight important soil series in Kentucky were measured periodically during the summer growing season for four years, 1977 through 1980. The soils divided into three groups according to their behavior. The first group (Maury and Crider) is well-drained and never showed excess water above field capacity at any time during the four seasons. The second group (Zanesville, Lowell, Calloway, Grenada and Shelbyville) showed perched water tables at times, especially during the early part of the growing season. The third group was represented by the Huntington soil which has a permanent water table. The in-situ field capacity or upper limits was determined on numerous samples of the Maury, Crider and Shelbyville soil series. Variation within series was rather low, indicating that samples taken at one site are representative of the soil in general. A model for estimating the soil water in each 15 cm layer was developed and proved to work very well with both Maury and Crider soils. Lowell soil was predicted poorly by the model, with other soils being intermediate. A variation of the model which assumed that the lowest layer of the Huntington was always at the upper limit due to a permananent water table also worked well. The water calculated from the model as deep drainage was used as a measure of increase in streamflow and compared to measured streamflow on three watersheds and four soils in 1978 and 1979.
W81-03260

METHODS OF SOIL HYDRAULIC CONDUCTIVITY DETERMINATION AND INTERPRETATION,
ABC Dirt Soil Scientist, Seattle, WA.
D. W. Roberts, and M. A. Nichols.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 43-57. 7 Fig, 2 Tab, 37 Ref.

Descriptors: *Permeability coefficient, *Soil water, *Soil physics, *Soil structure, Root zone, Water table, Aeration zone, Field tests, *Land disposal, Waste disposal, Linings.

The basic principles involved in water movement are presented as they apply to movement within the root zone, use of compacted soil layers as liners for landfills and surface impoundments, and move-

ment between the root zone or liner and the water table. Water movement may occur under saturated or unsaturated flow conditions, and in natural soils will be affected by anisotropy and the phenomenon of hysteresis. Both saturated and unsaturated flow may be tested by field and laboratory tests, both of which have advantages and disadvantages. The main advantages of laboratory tests are economy and convenience while the major disadvantage is that the sample is not representative of field conditions. Field tests reflect conditions more accurately, but are hampered by expense and the seasonal restrictions on testing. The applicability of various test methods for water movement in each soil zone is evaluated. All three zones of water movement must be tested when land-based waste disposal sites are being considered. The number of tests, their type and unit of land area to give the best characterization of the site will be based on what is already known, and the judgement of the researcher. (Brambley-SRC)
W81-03339

WATER BUDGET IN SOUTHERN TUNISIA, I. EXPERIMENTAL CHARACTERIZATION OF WATER MOVEMENT IN THE NONSATURATED ZONE. (BILAN HYDRIQUE DANS LE SUD-TUNISIEN I. CARACTERISATION EXPERIMENTALE DES TRANSFERTS DANS LA ZONE NON-SATUREE),
Centre National de la Recherche Scientifique, Grenoble (France). Inst. de Macanique de Grenoble.
G. Vachaud, M. Vauclin, and J. Colombani.
Journal of Hydrology, Vol 49, No 1/2, p 31-52, January, 1981. 14 Fig, 3 Tab, 7 Ref.

Descriptors: *Soil water movement, *Hydraulic conductivity, *Semiarid climates, Recharge, Unsaturated flow, Gypsum, Hydrology, *Tunisia, Water table, Groundwater recharge, Infiltration, Rainfall simulators, Simulated rainfall, Permeability, Hydrodynamics, *Hydrologic budget.

The possibility of water table recharge by natural rains in south Tunisia, a semi-arid zone, was determined by studying the water movement in a multilayered bare soil. Water was applied to the soil surface by a rain simulator, and soil water balance was measured during infiltration and redistribution of the water. At the depth of 90 cm a gypsum layer, formerly considered impermeable, showed high hydraulic conductivity and was believed responsible for the water table recharge. (Cassar-FRC)
W81-03468

WATER BUDGET IN SOUTHERN TUNISIA, II. NUMERICAL MODELLING AND ESTIMATION OF WATER MOVEMENT IN MULTILAYERED SOIL. (BILAN HYDRIQUE DANS LE SUD-TUNISIEN, II. MODELISATION NUMERIQUE ET PREVISION DES TRANSFERTS HYDRIQUES EN SOL STRATIFIE),
Centre National de la Recherche Scientifique, Grenoble (France). Inst. de Macanique de Grenoble.
M. Vauclin, and G. Vachaud.
Journal of Hydrology, Vol 49, No 1/2, p 53-73, January, 1981. 14 Fig, 1 Tab, 15 Ref.

Descriptors: *Soil water movement, *Model studies, *Soil moisture, Evaporation, Rainfall, Hydrology, *Tunisia, Remote sensing, Infiltration, *Hydrologic budget.

Part I of the present study measured water movement in layered soil after simulated rainfall had been applied to the surface. In this part the model is tested against experimental results and used to predict the water balance during and after a natural rain. Evaporation losses are predicted using Deardorff's parametrization of moisture content at the soil surface. The results indicate that evaporation may be determined on a large scale in connection with (especially microwave) remote sensing devices. (Cassar-FRC)
W81-03469

2H. Lakes

A COMPARISON OF PREDICTIONS AND MEASUREMENTS OF THE RADIATION FIELD IN A SHALLOW WATER LAYER,
Purdue Univ., Lafayette, IN. Heat Transfer Lab.
F. P. Incropera, T. R. Wagner, and W. G. Houf.
Water Resources Research, Vol 17, No 1, p 142-148, February, 1981. 11 Fig, 15 Ref. OWRT-A-058-IND(1).

Descriptors: *Optical properties, *Solar radiation, *Shallow water, Model studies, Heat transfer, Water properties, Physical properties, Bodies of water, Radiation, Reflectance, Refractivity, Air-water interfaces, Surface water.

Solar radiation transfer in a body of water is affected by several factors: the directional distribution of the incident radiation, reflection and refraction at the air-water interface, absorption and multiple scattering within the water, and reflection off the bottom surface. To date, the only laboratory comparison with theoretical solutions has involved a dense algal suspension with negligible bottom reflection. This paper extends such a comparison to water extracted from the Wabash River, more representative of the natural environment. Measurements of the directional and spatial distribution of the spectral radiation have been made in a diffusely irradiated aqueous medium, and results compared with predictions made by the discrete ordinate and three-flux methods. For the region in which radiation is concentrated within a cone of half angle 0.85 rad, good agreement is obtained with the discrete ordinate method. Good agreement is also obtained between radiation fluxes measured for the forward direction and predictions based on both the discrete ordinate and three-flux methods. Uncertainties in the radiation intensity and phase function measurements probably cause the discrepancies noted between predicted and measured results for half angles $>$ 0.85 rad. (Cassar-FRC)
W81-03284

HEC ACTIVITIES IN RESERVOIR ANALYSIS,
Hydrologic Engineering Center, Davis, CA.
V. R. Bonner.
Technical Paper No 75, June, 1980. 9 p, 1 Fig, 1 Tab, 18 Ref.

Descriptors: *Lakes, *Reservoirs, *Computer models, *Computer programs, Flood control, Flood-control storage, Reservoir yield, Simulation, Flow control, Flood forecasting, Water quality, Pollutants, Water temperature, Hydraulics.

A review of model development is presented, with an overview of the capabilities and types of applications for the most recent computer programs HEC-5 and Water Quality for River-Reservoir Systems (WQRRS). The early studies with HEC-5 were generally flood control planning, but it is now being applied to reservoir yield determination problems, to determine the potential gains from reallocation of flood control storage, and to provide an interactive output display package of flood simulation results. The simulations can be used to assist in reservoir release decisions and provide downstream flow predictions. The WQRRS model now contains three separate but integrable modules: the reservoir module; the stream hydraulics module; and the stream quality module. The reservoir module is designed to provide a detailed portrayal of the important processes that determine the thermal and water quality characteristics of lakes and reservoirs. In the stream quality module the rate of transport of quality parameters can be represented for aerobic streams. Peak pollutant loads can be routed through steady or unsteady flow conditions using the routing from the stream hydraulic model. These models may become useful tools for application to operation problems on a 'real-time' basis. (Brambley-SRC)
W81-03321

A TIME- AND DEPTH-DEPENDENT MODEL FOR PHYSICAL, CHEMICAL AND BIOLOGICAL CYCLES IN TEMPERATE LAKES,
Washington Univ., Seattle. Dept. of Oceanography.
R. A. Walters.
Ecological Modelling, Vol 8, p 79-96, January, 1980. 5 Fig, 1 Tab, 36 Ref.

Descriptors: *Model studies, *Lakes, *Limnology, Stratification, Nutrients, Temperate zone, Thermal stratification, Eutrophication, Mathematical models, Turbulence, Chlorophyll, Water circulation, Mixing, Diffusion, Eddies, Biological properties, Chemical properties.

A numerical model designed for studying the complex relationships that exist between chemical, physical, and biological processes which occur in deep stratified lakes of the temperate zone is described. Results of a mathematical model of the thermal stratification cycle of a deep lake are combined with a phytoplankton growth and nutrient concentration model to ensure consistency of the vertical eddy diffusion of algal cells and dissolved nutrients with the mixing processes that determine the lake's thermal stratification. Results of simulation trials were in good agreement with measured distributions from Lake Washington in Washington state. Turbulent mixing processes in the thermal model controlled the chlorophyll a and distribution of nutrients. The thermal model utilizes a heat diffusion equation whhich is nonlinear and reflects the interaction of wind-induced turbulence and buoyancy gradients related to surface heating and cooling. Changes in surface heat are described by standard meteorological parameters, and both finite-difference and finite-element algorithems are used to solve the thermal model. A pair of coupled, nonlinear partial differential equations used to form the biological production model is solved by the finite differences approach and an iteration technique. The equations govern the distribution of chlorophyll a and dissolved phosphorus. (Geiger-FRC)
W81-03402

AN ECOLOGICAL MODEL OF LAKE ONTARIO,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
D. Scavia.
Ecological Modelling, Vol 8, p 49-78, January, 1980. 8 Fig, 5 Tab, 86 Ref.

Descriptors: *Ecosystems, *Lake Ontario, *Model studies, *Cycling nutrients, Great Lakes, Seasonal, Sedimentation, Phytoplankton, Zooplankton, Phosphorus, Nitrogen, Carbon, Dynamics, Dissolved oxygen, Detritus, Lakes.

A modified version of an earlier model developed to simulate the flow of carbon, nitrogen and phosphorus through the food web of Lake Ontario is described. The International Field Year for the Great Lakes (IFYGL) program funded the development of this mathematical model, which is based on realistic process equations posed by experimentalists over the past several decades. The ecological model simulates observations made of several phytoplankton and zooplankton groups, components of the nitrogen, phosphorus, carbon and silicon cycles, particulate sediment and pore water dynamics and dissolved oxygen. Output from the three layer model is channeled into a carbon flow diagram to show the significance of herbivorous zooplankton and detritus in the Lake Ontario ecosystem. Seasonal dynamics and the effects of sediments on nutrient fluxes are also considered. The updated IFYGL model is recommended as a synthesis tool for the analysis of the Great Lakes and other large aquatic ecosystems. (Geiger-FRC)
W81-03403

LAKE KINNERET WATER BIOTOPES: A MATHEMATICAL MODEL OF THERMAL STRATIFICATION FOR ECOLOGICAL PURPOSES,
Kinneret Limnological Lab., Tiberias (Israel).
H. Volohonsky, E. Shmain, and S. Serruya.
Ecological Modelling, Vol 9, p 91-120, March, 1980. 15 Fig, 6 Tab, 14 Ref.

Descriptors: *Thermal stratification, *Lakes, *Mathematical models, Model studies, Lake Kinneret, *Ecology, Mixing, Limnology, Temperature, Thermocline, *Israel.

This paper describes the use of appropriate differential equations to represent the process of water mass exchange between different layers of lake ecosystems. Modelling was performed for Lake Kinneret ecology, and the mathematical model used is called WBIOTOP, which is a simulated deterministic model of formation, maintenance and destruction of water biotopes. At each step the state of the water-body is represented in terms of temperatures at the interfaces of up to four basic layers and in terms of the altitudes of these interfaces. For wind-mixed and transient epilimnic layers, zero gradients of temperature are assumed. Constant non-zero gradients are assumed for meta- and hypolimnion. State to state transitions are represented as superpositions of a set of separate processes governed by two main physical factors, wind-speed and heat input. Direct wind action, heat input or output, and the lateral effect of wind action are the processes accounted for in the model. A separate submodel is used to determine the step duration, representing a measured wind-pattern on the time scale as a series of stormy and still events. The information provides terms for water-mass transfer from and to main water biotopes. The model thus becomes a convenient basis for an ecological model. (Baker-FRC)
W81-03406

DIFFERENTIAL PHYTOPLANKTON SINKING- AND GROWTH-RATES: AN EIGENVALUE ANALYSIS,
Iowa Univ., Iowa City, Dept. of Environmental Engineering.
J. L. Schnoor, and D. M. Di Toro.
Ecological Modelling, Vol 9, p 233-245, April, 1980. 3 Fig, 2 Tab, 18 Ref.

Descriptors: *Lakes, *Phytoplankton, *Growth rates, *Distribution patterns, Lake Lyndon B. Johnson, Texas, Lake Erie, Eutrophication, Algae, Plant populations, Ecological distribution, Aquatic life, Aquatic plants, Reservoirs.

Eigenvalue analysis was applied in a study of the phytoplankton found in Lake Lyndon B. Johnson in Texas, and in Lake Erie. Factors which determine the phytoplankton composition are analyzed as well as losses due to turbulent mixing and to sinking as well as a death-term to account for endogenous decay and predation. Community and individual C-14 production data allowed gross growth-rates to be calculated along with information obtained from biomass measurements. The largest gross growth-rates were found among green algae, 1-1.75/day, with the largest calculating sinking rates also of 1-3 meters/day. Blue green algae and phytoflagellates exhibited the lowest gross growth rates of less than 0.5/day and sinking-rates of less than 0.1 meter/day. Diatoms were intermediate, with growth rates generally in the range of 0.25-0.75/day and calculated sinking rates of 0.1-1.0 meters/day. (Baker-FRC)
W81-03407

SELF-OPTIMIZATION IN A PHYTOPLANKTON MODEL,
Technology Inst., Ilmenau (Germany, F.R.). Technical and Biomedical Cybernetics Dept.
E. Radtke, and M. Straskraba.
Ecological Modelling, Vol 9, p 247-268, May, 1980. 12 Fig, 2 Tab, 54 Ref.

Descriptors: *Ecosystems, *Model studies, *Phytoplankton, Mathematical modeling, Nutrients, Bodies of water, Ecology, Ecological distribution, Aquatic life, Aquatic plants.

A review was made of the holistic approach to modeling of ecosystems. Goal-function and the use of optimization procedures were used as the basis of this critical review. The rates of five different sub-processes of phytoplankton changes were treated as continuous functions of the individual algal or colony cell-size in the dynamic model of phytoplankton - zooplankton - phosphorus interactions. Indirect effects due to feedback within the system were superimposed on the direct differences in rates. Use of penalty-shifting algorithms to maximize the integral algal biomass by means of dynamic optimization methods resulted in the selection of models favoring different algae during the annual run. Three different procedures were evaluated. The algorithm was modified for dynamic optimization problems, but difficulties arose with retaining the cyclicity of the natural system with these changes.(Baker-FRC)
W81-03408

GAS EXCHANGE RATES FOR THREE CLOSED-BASIN LAKES,
Lamont-Doherty Geological Observatory, Palisades, NY.
T-H. Peng, and W. Broecker.
Limnology and Oceanography, Vol 25, No 5, p 789-796, September, 1980. 7 Fig, 6 Tab, 9 Ref.

Descriptors: *Carbon dioxide, *Gases, *Lakes, Carbon radioisotopes, Pyramid Lake, Walker Lake, Mono Lake, Wind velocity, Hydrogen ion concentration, Salinity, Limnology, *Nevada.

Mean CO2 invasion rates were determined for three closed-basin lakes in the western U.S. after 22 years of monitoring the C14/C12 ratio. Results varied widely: Pyramid Lake, 6 mol per sq meter per year; Walker Lake, 17; and Mono Lake, 38. Explanations for the high values for Mono Lake may be the influx of C14-free spring water, higher pH, and salinity. Wind velocity can be a factor, but in the absence of measurements, this is assumed to be similar among the three lakes. Water temperature has little effect on CO2 invasion rates from 0 to 30C. (Cassar-FRC)
W81-03425

ENDOGENOUS NITRATE PRODUCTION IN AN EXPERIMENTAL ENCLOSURE DURING SUMMER STRATIFICATION,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
N. Christofi, T. Preston, and W. D. P. Stewart.
Water Research, Vol 15, No 3, p 343-349, March, 1981. 9 Fig, 31 Ref.

Descriptors: *Nitrification, *Stratification, *Lakes, Nitrates, Nitrogen removal, Nitrogen cycle, Bacteria, Sediments, Microorganisms, Blelham Tarn, English Lake District.

During the summer of 1976 the biological production of nitrate was studied in an experimental enclosure in a water column of 18,500 cubic meter capacity in Blelham Tarn, English Lake District. A solution of 11 kg NaNO3 and 0.789 KH2PO4 was sprayed onto the surface waters of the enclosure in August of 1976, when the water column was thermally stratified. Nitrification was detected in the water column during stratification and was maximal within a 2 m deep zone centered on a depth of 8.0 m in the metalimnion and upper hypolimnion, where numbers of autotrophic nitrifying bacteria were highest. During the period of highest activity, nitrification produced a total of 950 g of nitrate-nitrogen, an amount equivalent to 50% of the fertilizer nitrogen added to the epilimnion. If redistributed throughout the water column, this would add 53 micrograms N to every liter of enclosure water, a concentration probably sufficient to cause a large phytoplankton development. The development of zones of nitrification at ammonium-oxygen chemoclines is of particular interest considering the seasonal pattern of deoxygenation and sediment ammonium release in eutrophic lakes subject to stratification. Nitrification has a central role to play in the nitrogen cycle of lakes, increasing the amount of available nitrate, facilitating nitrogen transport across ammonium-oxygen chemoclines, and facilitating nitrogen removal. (Baker-FRC)
W81-03441

DEVELOPMENT OF A COMPUTER-GENERATED EQUILIBRIUM MODEL FOR THE VARIATION OF IRON AND MANGANESE IN THE HYPOLIMNION OF LAKE MENDOTA,
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
M. R. Hoffman, and S. J. Eisenreich.
Environmental Science and Technology, Vol 15, No 3, p 339-344, March, 1981. 5 Fig, 3 Tab, 47 Ref.

Descriptors: *Manganese, *Iron, *Model studies, *Hypolimnion, Hydrogen ion concentration, Path of pollutants, Chemical reactions, Mathematical models, *Lake Mendota, Wisconsin, Lakes, Sediment-water interfaces, Lake sediments, Stratification, Eutrophication, Oxides, Sulfides, Carbonates, Inorganic compounds, Chelation, Solubility, Water pollution effects.

A computer-based model was moderately successful in exploring the unusual seasonal variation of Fe and Mn in the hypolimnetic water above the sediments in Lake Mendota, Wisconsin. In this eutrophic, hard-water lake, Mn is released preferentially during thermal stratification even though the Fe:Mn ratio in the sediments is 19:1. Waters at the sediment-water interface are high in carbonate, phosphate, and sulfide. Results indicate that pH is the primary controlling variable in release of Mn from MnCO3 and desorption of Mn(2+) from oxide surfaces. Progressive appearance of Fe is predicted in terms of a pH-dependent dissolution of iron oxides as influenced by organic complexation. The concentrations of Mn and Fe ionic species present at pH 6.9 to 8.7 are presented in curves. (Cassar-FRC)
W81-03452

HYDROLOGY OF A SMALL LAKE IN THE CANADIAN HIGH ARCTIC,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2C.
W81-03459

CHANGE IN MONOSACCHARIDE COMPOSITION IN THE COURSE OF DECOMPOSITION OF DISSOLVED CARBOHYDRATES IN LAKE WATER,
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
M. Ochiai, and T. Hanya.
Archiv fur Hydrobiologie, Vol 90, No 3, p 257-264, November, 1980. 4 Fig, 22 Ref.

Descriptors: *Lakes, *Carbohydrates, *Decomposing organic matter, Organic matter, Organic compounds, Monosaccharides, Bacteria, Water quality, *Lake Nakanuma, Japan.

Water samples from Lake Nakanuma, Japan, were stored in the dark to decompose for 31 days. Concentrations of dissolved organic carbon and 8 common monosaccharides were determined at the start and after 10, 20, and 31 days. Dissolved organic carbon decreased from 4.41 mg C per liter to 3.91 mg C per liter at 10 days and to 3.52 mg C per liter at 31 days. Original concentrations of sugars in micrograms per liter were as follows: rhamnose, 81; fucose, 85; ribose, 14; arabinose, 65; xylose, 71; mannose, 77; galactose, 184; glucose, 335; and total dissolved carbohydrate, 910. The greatest decreases were seen in glucose and galactose at 10 days, to 51 and 85 micrograms per liter respectively. Ribose and arabinose varied little over the entire 31 day experiment. The remaining compounds decreased moderately up to 10 days. None of the monosaccharide levels decreased much after 10 days. After 31 days' decomposition, the monosaccharide composition was similar to that of water at 6 meters depth. Rate constants of the decomposition reactions suggested that glucose and galactose were more easily used by heterotrophic bacteria. Whether dissolved organic matter is freshly produced or aged can be determined from the monosaccharide composition of the dissolved carbohydrates. (Cassar-FRC)
W81-03464

PLANKTONIC BLUE-GREEN ALGAE: PRODUCTION, SEDIMENTATION, AND DECOMPOSITION IN LAKE MENDOTA, WISCONSIN,
Wisconsin Univ.-Madison. Dept. of Bacteriology.
R. D. Fallon, and T. D. Brock.

Limnology and Oceanography, Vol 25, No 1, p 72-88, January, 1980. 7 Fig, 3 Tab, 32 Ref.

Descriptors: *Plankton, *Lakes, *Algae, Algal growth, *Lake Mendota, Wisconsin, Decomposition, Sedimentation, Algal blooms.

Growth, primary production, and sedimentation were measured during two annual phytoplankton cycles occurring in 1976 and 1977 in Lake Mendota, Wisconsin. After lake stratification, blue-green algal blooms developed in a succession of dominant genera. Early populations were dominated by Aphanizomenon and Anabaena. By midsummer Microcystis became more important. A combination of epilimnetic decomposition and sedimentation accounted for the periodic declines in blue-green algal standing crop. Decomposition was primarily important for Aphanizomenon and Anabaena. Sedimentation was a more significant factor for the decline of Microcystis. Values for annual sediment accumulation were obtained from coring data. These were compared with estimates for annual sediment accumulation that were obtained by correcting the observed sedimentation rates for resuspension. The two values agreed fairly well. About 57-67% of the organic carbon was lost from particles of blue-green algae during sedimentation due to decomposition. At the sediment surface further decomposition occurred, so that only about 11% of the original organic material was more or less permanently buried. Significant decomposition had occurred during sedimentation, as evidenced by the amounts of blue-green algal volume, particulate chlorophyll, and particulate phosphorus measured in the traps. (Baker-FRC)
W81-03471

EVIDENCE FOR ALGAL HETEROTROPHY IN LAKE TAHOE, CALIFORNIA-NEVADA,
California Univ., Davis.
For primary bibliographic entry see Field 5A.
W81-03475

METHANE OXIDATION IN LAKE TANGANYIKA (EAST AFRICA),
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
J. W. M. Rudd.
Limnology and Oceanography, Vol 25, No 5, p 958-963, September, 1980. 2 Fig, 1 Tab, 22 Ref.

Descriptors: *Lake Tanganyika, *Lakes, *Methane bacteria, Bacteria, Methane, Oxidation, Limnology, Africa.

Methane oxidation rates for 5 stations on Lake Tanganyika were estimated at 3.1 nmol per sq meter per year, 10% of annual primary productivity. Seasonal variations were 3.8 to 5.8 nmol per sq meter per day. Methane oxidizers were most active between the permanently anoxic monimolimnion and the seasonally mixed layer. During the dry season methane oxidation may be intermittent and of variable intensity depending on water circulation. An average of 74% of methane oxidized was converted to CO2, the remainder into cell material. (Cassar-FRC)
W81-03520

SUBLACUSTRINE CHANNELS IN LAKE WANAKA,
Department of Scientific and Industrial Research, Wellington, (New Zealand). Oceanographic Inst.
J. Irwin.
New Zealand Journal of Marine and Freshwater Research, Vol 14, No 1, p 87-92, 1980. 4 Fig, 15 Ref.

Descriptors: *Lakes, *Inflow, *Channels, Density currents, Lake Wanaka, *New Zealand, Turbidity currents, *Lake morphology.

A study was made of the sublacustrine channels off the two major inflowing rivers in Lake Wanaka, New Zealand. Main inflows to the lake are the Makarora River at the north end and the Matukituki River on the south-west side. Outflow is to the south-east by way of the Clutha River. These channels provide a preferred path for density flows of turbid inflowing river waters whether these are continuous or intermittent. Sediments high on the delta slope may become unstable from time to time and cause slumping of the steep forest slope, generating impulsive density flows. The channels end where the horizontal sediment surface in the deep lake basin begins and are thus intimately involved in the present sedimentary processes. (Baker-FRC)
W81-03541

COMPARATIVE SEASONAL ESTIMATES OF PRIMARY PRODUCTIVITY IN THE WAIKATO RIVER LAKES DURING SUMMER, AUTUMN, AND WINTER,
Auckland Univ., (New Zealand). Dept. of Zoology.
C. H. D. Magadza.
New Zealand Journal of Marine and Freshwater Research, Vol 14, No 1, p 71-77, 1980. 2 Fig, 3 Tab, 17 Ref.

Descriptors: *Trophic level, *Lakes, *Distribution pattern, Waikato River, *New Zealand, Eutrophication, Oligotrophy, Seasonal.

Measurements of primary productivity in six lakes were recorded in late summer, autumn, and winter of 1972 along the Waikato River in New Zealand. Measurements were taken at 1 and 10 m depths. Carbon productivity varied from 17.68 mg/cubic meter/hr in oligotrophic Lake Aratiatia to 509.4 mg/cubic meter/hr in eutrophic Lake Karapiro during the summer at 1 meter depth measurements. The highest values were recorded in autumn. Winter values at 1 m were lower than summer and autumn values by an order of magnitude. Productivity was light limited at 10 meter depths, and was comparable in all the lakes in summer and autumn assays. Winter findings were another order of magnitude lower. Nitrogen availability and light penetration were the principal factors that affected productivity. (Baker-FRC)
W81-03543

SATELLITE DETECTION OF SEICHES IN GREAT SALT LAKE, UTAH,
National Oceanic and Atmospheric Administration, Washington, DC.
For primary bibliographic entry see Field 7B.
W81-03549

ASPECTS OF THE PHYSICS, CHEMISTRY, AND PHYTOPLANKTON BIOLOGY OF LAKE TAUPO,
Department of Scientific and Industrial Research, Taupo (New Zealand).
E. White, M. Downes, M. Gibbs, L. Kemp, and L. Mackenzie.
New Zealand Journal of Marine and Freshwater Research, Vol 14, No 2, p 139-148, 1980. 4 Fig, 5 Tab, 22 Ref.

Descriptors: *Water properties, *Lakes, *Phytoplankton, *Chemical stratification, Water analysis, Chemocline, Algae, Phosphorus, Nitrogen, *New Zealand.

Early findings are reported in a continuing study of the limnology of Lake Taupo. Water samples were collected monthly from August 1974 to March 1976 at three sites where the lake was about 100 m deep. Physical and chemical characteristics of the water were determined. The lake stratified in summer and mixed freely in winter, when water temperatures dropped to 10-11C. Oxygen depletion in bottom waters towards the end of the stratification period was about 4 gm/cu m. Secchi disc analysis showed that water transparency ranged from 11 to 21 m. The pH was between 7 and 8, and major ion concentrations totaled about 2.3 eq/cu m. Anion concentrations followed the pattern HCO3(-) > Cl(-) > SO4(2-), while cations followed the pattern Na(+) > Ca(2+) > Mg(2+) > K(+). The state of lake stratification and phytoplankton populations were related to the distributions of reactive phosphorus and nitrate-nitrogen, which caused pronounced seasonal chemoclines. There were 24 genera of algae represented in cell counts. Chlorophyll concentrations in the top 30 m of the lake varied between 0.65 mg/cu m and 2.9 mg/cu m. A pronounced winter peak was associated with a phytoplankton population dominated by Melosira granulata. (Small-FRC)
W81-03572

SEASONAL SUCCESSION AND VERTICAL DISTRIBUTION OF ZOOPLANKTON IN LAKE HAYES AND LAKE JOHNSON,
Otago Univ., Dunedin (New Zealand). Dept. of Zoology.
C. W. Burns, and S. F. Mitchell.
New Zealand Journal of Marine and Freshwater Research, Vol 14, No 2, p 189-204, 1980. 9 Fig, 7 Tab, 33 Ref.

Descriptors: *Eutrophic lakes, *Zooplankton, *Vertical distribution, *Seasonal distribution, *Succession, Rotifers, Crustaceans, Daphnia, Aquatic productivity, Biomass, Seasonal variation, *New Zealand.

The composition, vertical distribution, and abundance of the crustacean zooplankton and the rotifer Asplanchna in Lakes Hayes and Johnson (New Zealand) are discussed. Samples were collected near the deepest part of the lakes every 4 or 5 weeks during December 1969 through February 1972. In Lake Hayes, Boeckella dilatata was the dominant crustacean, while Ceriodaphnia dubia was subdominant. In Lake Johnson, Ceriodaphnia was dominant and Bosmina meridionalis and Boeckella were subdominant. In Lake Hayes, Daphnia were common in spring, but they were very rare in Lake Johnson. In summer, Chydorus and Asplanchna appeared in both lakes. Biomass was highest in spring, and animals occurred at all depths during holomixis, but were nearer to the surface during stratification. Spring biomass in Lake Hayes ranged from 0.7 to 4.6 gm/sq m dry weight, and in Lake Johnson it ranged from 0.3 gm/sq m in March of 1971 to 7.4 gm/sq m in November. Both lakes are eutrophic. Lake Johnson developed a stratum of anoxic water in the metalimnion each summer. Cyclopoids were becoming more abundant in Lake Hayes, which indicates increasing eutrophication. (Small-FRC)
W81-03574

2I. Water In Plants

COMPARATIVE ESTIMATES OF INTERCEPTION LOSS FROM THREE CONIFEROUS FORESTS IN GREAT BRITAIN,
Institute of Hydrology, Wallingford (England).
J. H. C. Gash, I. R. Wright, and C. R. Lloyd.
Journal of Hydrology, Vol 48, No 1/2, p 89-105, August, 1980. 4 Fig, 2 Tab, 20 Ref.

Descriptors: *Interception, *Canopy, *Evaporation, *Coniferous forests, Model studies, Meteorological data, Precipitation, Rainfall, Stemflow, Water loss, Throughfall, Forests, *Great Britain.

Models developed by Rutter (1971, 1975) and Gash (1979) were used to estimate the rainfall interception from three coniferous forests in Great Britain. The first is a numerical computer model which calculates the running water balance of canopy and trunks from inputs of hourly rainfall and weather parameters affecting evaporation. The second is a simpler analytical model of interception loss. Although there were differences between observed and calculated evaporations, the errors were considered to fall within acceptable limits for the errors inherent in the components. The mean optimized value for interception loss in the climate of Great Britain was 0.22 mm per hour. (Cassar-FRC)
W81-03430

THE EFFECT OF AFFORESTATION WITH EUCALYPTUS GRANDIS HILL EX MAIDEN AND PINUS PATULA SCHLECHT. ET CHAM. ON STREAMFLOW FROM EXPERIMENTAL CATCHMENTS AT MOKOBULAAN, TRANSVAAL,
Department of Forestry, Stellenbosch (South Africa).
W. S. Van Lill, F. J. Kruger, and D. B. Van Wyk.

Journal of Hydrology, Vol 48, No 1/2, p 107-118, August, 1980. 7 Fig, 3 Tab, 19 Ref.

Descriptors: *Streamflow, *Forest management, *Soil-water-plant relationships, Consumptive use, Trees, Evapotranspiration, Alteration of flow, Eucalyptus, Pinus, *South Africa, Watersheds(Basins), Forest watersheds, Rainfall, Hydrology, Rainfall-runoff relationships.

The effect of afforestation on streamflow was studied in the Eastern Transvaal escarpment, South Africa. After 12 years calibration on natural grass cover, one area was planted to Eucalyptus grandis in 1969 and a second to Pinus patula in 1971. The third area was left as a control. Starting with the third year Eucalyptus grandis reduced streamflow 300-380 mm per year, expressed as rainfall equivalents. Maximum reduction in seasonal flow was 200-260 mm per year in summer and 100-130 mm per year in winter. The level remained constant after the fifth year. Pinus data are tentative. Preliminary observations suggest that streamflow reduction is smaller and is delayed by a year. (Cassar-FRC)
W81-03433

SALT MARSH PRODUCTIVITY WITH NATURAL AND ALTERED TIDAL CIRCULATION,
San Diego State Univ., CA. Dept. of Biology.
For primary bibliographic entry see Field 2L.
W81-03511

FURTHER OBSERVATIONS ON THE WATER RELATIONS OF PROSOPIS TAMARUGO OF THE NORTHERN ATACAMA DESERT,
Stanford Univ., CA. Dept. of Biological Sciences.
H. A. Mooney, S. L. Gulmon, P. W. Rundel, and J. Ehleringer.
Oecologia, Vol 44, No 2, p 177-180, January, 1980. 3 Fig, 10 Ref.

Descriptors: *Soil-water-plant relationships, *Deserts, *Consumptive use, *Phreatophytes, Root zone, Tamarugo, Arid lands, *Chile, Moisture availability, Capillary fringe.

The phreatophyte Prosopis tamarugo, native to the Atacama desert of northern Chile, has unique water relations. Its native habitat is hot and dry, with virtually no precipitation, and infrequent floods. It is proposed that this mesquite tree uses groundwater for growth: roots 3.5 cm in diameter were found at a depth of 3.5 meters, the deepest possible excavation. As the growth season progresses, the tree comes under increasing water stress, water utilization exceeding the replacement rate. Other researchers have proposed that the tree uses atmospheric water, in spite of the fact that dew in this area is very unusual. This paper proposes that water moves from the plant into the soil of the root mat zone at night, moistening this area. The water is subsequently reabsorbed as the water table capillary fringe is depleted, toward the end of the growing season. (Cassar-FRC)
W81-03512

2J. Erosion and Sedimentation

GRAVEL BED COMPOSITION IN OREGON COASTAL STREAMS,
Oregon State Univ., Corvallis. School of Forestry.
J. N. Adams, and R. L. Beschta.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 10, p 1514-1521, October, 1980. 2 Fig, 4 Tab, 38 Ref.

Descriptors: *Sediment transport, *Gravels, Fine aggregates, Streambeds, Particle size, Land use, *Oregon, Streamflow, Aquatic habitats, Fish reproduction, Watersheds(Basins), High flow, Flow characteristics, Streams, Small watersheds, *Coastal streams.

Five gravel-bedded streams in the Oregon Coast Range were studied from winter 1977 through spring 1979. Frozen core samples of the streambed were collected monthly and after storm events to determine the amount of fine sediments (less than 1 mm), which can interfere with fish reproduction. Although the five streams were in similar climatic and physiographic regions, fines varied widely between streams, between locations in a stream, and between locations in the same riffle. Fines were occasionally flushed during periods of high flow. The amount of fines averaged 19.4% (range, 10.6-29.4%) in 21 streams in undisturbed watersheds sampled during the low summer flow. Regression analysis of this data indicated that the percentage of fine sediment in the bed was influenced by watershed slope, area, relief, and land use. Within a given stream, the fine sediment is related to stream sinuosity and bank-full stage. (Cassar-FRC)
W81-03391

2K. Chemical Processes

ORIGIN OF THE CHEMICAL COMPOSITION OF UNDISTURBED FORESTED STREAMS, WESTERN OLYMPIC PENINSULA, WASHINGTON STATE,
Washington Univ., Seattle. Coll. of Forest Resources.
A. G. Larson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-208209, Price codes: A11 in paper copy, A01 in microfiche. PhD Dissertation 1979. 216 p, 35 Fig, 30 Tab, 136 Ref, 7 Append. OWRT-A-103-WASH(2).

Descriptors: *Ion transport, *Forest watersheds, *Chemical composition, *Earth-water interfaces, *Washington, Basins, Ions, Anions, Cations, Water analysis, Soil analysis, Watersheds, Forest hydrology, Forest soils, Forests, Chemical analysis, Chemical properties, Chemical stratification, Solubility, Catchment areas, Flow discharge.

Six zones of a watershed, three biologically-active zones (covering vegetation and soils; biopedological compartment) and three geochemical reaction zones (covering subsoil, parent material, and bedrods; geochemical compartment), believed to impact solution composition were defined. Annual water volumes passing through each zone and their average chemical composition were determined. Monitoring ionic concentrations at zone boundaries defined zone impacts on solution composition; ionic concentration differences between inflowing/outflowing water reflects reactions within a zone; dissolved ions in precipitation, throughfall, stemflow, soil water, springs, and streams represented zone inputs/outputs. Chemical weathering of rock minerals in the geochemical compartment was the principal process controlling dissolved ion concentrations in stream water, with forest vegetation and soils representing only a minor source. While the geochemical compartment was nonconservative relative to dissolved ions, the biopedological compartment was relatively conservative. Ionic stream water concentrations for K, Mg, Ca, bicarbonate, sulfate and silica reflected geochemical reactions, stream water nitrogen and phosphorus levels were controlled biologically. Watershed and watershed zone elemental budgets were determined and discussed. (Zielinski-IPA)
W81-03265

IN SITU MEASUREMENTS OF SEDIMENT-WATER NUTRIENT EXCHANGE RATES IN THE CHOWAN RIVER,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. B. Albert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209181, Price codes: A04 in paper copy, A01 in microfiche. Master of Science Thesis, 1980. 47 p, 7 Fig, 6 Tab, 47 Ref. OWRT-B-127-NC(1).

Descriptors: *Sediment-water interfaces, *Sediments, *Cycling nutrients, *Nitrogen, *Phosphorus, *Fluctuations, Computer model, Soil types, Interfaces, Earth-water interfaces, Mud-water interfaces, Sediment sampler, Marine sediments. Bottom sediments, Nutrients, North Carolina, Phosphates, Phosphorus compounds, Ammonium, Nutrient requirements, Profiles, *Chowan River.

In June, 1980, an extensive series of in-situ measurements was made of exchanges of phosphorus (P) and nitrogen (N) species and dissolved oxygen at several Chowan River sites. Sediments involved in flux measurements were collected and analyzed. Study was conducted to relate sediment characteristics to measured fluxes to discern generalizations. P fluxes (micromoles/sq. meter/day (R)) were dominated by phosphate (average R of 99 and an R range from -45 to 360). N fluxes were dominated by ammonium (mean R of 2190 and an R range of 160-12,000). Nutrient fluxes did not correlate with sediment carbon, N, P, sand, silt, or clay. Comparison of average R values with productivity data from June and July, 1975, indicated these fluxes could have supplied 27 and 20% of the N and P requirements of the phytoplankton in 1975. In-situ time-course measurements showed ammonium fluxes were linear with time; phosphate fluxes were more erratic. Ammonium and phosphate in-situ flux measurements were not estimated well by a diffusion model based on interstitial water concentration profiles. (Zielinski-IPA)
W81-03266

2L. Estuaries

UTILIZATION OF TIDAL CURRENTS BY ESTUARINE ZOOPLANKTON,
Port Elizabeth Univ. (South Africa). Dept. of Zoology.
T. Wooldridge, and T. Erasmus.
Estuarine and Coastal Marine Science, Vol 11, No 1, p 107-114, July, 1980. 6 Tab, 16 Ref.

Descriptors: *Zooplankton, *Estuaries, *Tidal effects, *Currents(Water), *Distribution patterns, Seston, Copepods, Aquatic life, Aquatic animals, Drifting(Aquatic), Animal behavior, Behavior, Crustaceans, Invertebrates, Sundays River, *South Africa.

The Sundays River estuary, Port Ely, South Africa, is 21 km long and 500 meters wide at the mouth. Although strong tidal currents and a short flushing time were characteristic of this body of water, endemic zooplankton were nevertheless plentiful, suggesting that they were utilizing the currents for minimizing transport to the sea. The copepod, Pseudodiaptomus hessei, avoided fast-flowing surface currents and was evenly distributed during slack water. Acartia longipatella and A. natalensis congregated near the bottom at ebb tide and moved laterally into areas of slowest-moving current. On the flood tide, A. longipatella was found in the slower currents and A. natalensis in the fast currents, thus being transported further upstream. Specimens of the mysid, Rhopalophthalamus terranatalis, especially the adults, avoided the surface and were found in fast currents on the flood tide and slow currents on the ebb tide. Mesopodopsis slabberi preferred the bottom and was in the slow current at ebb tide and in the fast current at flood tide, migrating both vertically and laterally. (Cassar-FRC)
W81-03418

SEDIMENT DYNAMICS IN THE MACROTIDAL AVON RIVER ESTUARY, BAY OF FUNDY, NOVA SCOTIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Geological Sciences.
J. J. Lambaiase.
Canadian Journal of Earth Sciences, Vol 17, No 12, p 1628-1641, December, 1980. 21 Fig, 40 Ref.

Descriptors: *Estuaries, *Intertidal areas, *Tides, *Sediment transport, Currents(Water), Sand waves, Sedimentary structures, Avon River, Bay of Fundy, *Nova Scotia, Deltas, Ripplemarks, Sediments, Waves, Storms, Beds, Bottom sediments, Channel morphology, Sedimentation.

Major intertidal sand bodies are described in a study of the Avon Estuary, Bay of Fundy, Nova Scotia. This is a macrotidal estuary experiencing a tidal range from 15.6 m at lunar perigee to 8.2 m at neap tide. Effects of waves and storms on intertidal sand bodies were not important. Although waves of 1.25 m had been observed during a 130 mph

hurricane, waves were generally in the 0.3-0.6 m range. Tidal current velocities are strong, 0.6 m per sec at the mouth to 1.7 m per sec at the head. Maximum speeds are seen near the half tides, and minimum speeds at the high and low water. Most rapid flow occurs when the flow is channelized between sand bodies. Six major intertidal sand bodies, ranging from 0.80-5.6 km long and 0.40-0.95 km wide, exist in the estuary, three at the mouth and three nearer the head of the system. Most have a well developed crest running parallel to the long axis, which parallels the tidal currents. Three major bedforms occur: ripples, 0.30 m apart and less than 0.05 m high; megaripples, 0.5-10.0 m wave lengths and less than 0.85 m high; and sand waves, wave lengths up to 70 m, heights up to 2.0 m. Only a few transverse bars are seen. Sand waves and megaripples are found on all six sand bodies, ripples superimposed on larger bedforms. Mean grain size decreases and current velocity increases from the estuary mouth to the head. Sediment samples at the mouth are more poorly sorted than those at the head. Sand body position and shape resemble those in mesotidal systems because the flow pattern at the mouth is modified into an expanding jet, forming a tidal point bar, a flood tidal delta, and an ebb tidal delta. This indicates that the Hayes macrotidal estuary model cannot be applied to all macrotidal systems. (Cassar-FRC)
W81-03424

CONCENTRATION OF ANIONIC DETERGENTS IN RIO GRANDE WATER (SOUTH BRAZIL),
Universidade Federal do Rio de Janeiro (Brazil). Base Oceanografica Atlantica.
For primary bibliographic entry see Field 5B.
W81-03440

THE APPLICATION OF A SEGMENTED TIDAL MIXING MODEL TO THE GREAT BAY ESTUARY, N.H.,
New Hampshire Univ., Durham. Dept. of Earth Sciences.
W. S. Brown, and E. Arellano.
Estuaries, Vol 3, No 4, p 248-257, December, 1980. 9 Fig, 4 Tab, 13 Ref.

Descriptors: *Mixing, *Tidal effects, *Saline-water freshwater interfaces, Model studies, Mathematical models, Rivers, Estuaries, *Great Bay Estuary, New Hampshire, High flow, Low flow, Flow.

A modified version of the Dyer-Taylor mixing model was used to predict crude salinity distributions over a range of river discharge in the well-mixed Great Bay Estuary, New Hampshire. The theory was modified to account for the mixing which occurs at the junction of two branches in the estuary. The model was calibrated using data from a low river flow period and used to predict salinity at high river flow in late March. There was reasonable agreement between observed and predicted salinities in the lower estuary. Calculated and observed low water results were in better agreement than the high water figures. Calculated flushing times for water parcels entering the head of the estuary were low flow, 54.5 tidal cycles, and high flow, 45.9 tidal cycles (observed high flow, 36.1 cycles). (Cassar-FRC)
W81-03455

SEASONAL OXYGEN DEPLETION IN CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
J. L. Taft, W. R. Taylor, E. O. Hartwig, and R. Loftus.
Estuaries, Vol 3, No 4, p 242-247, December, 1980. 4 Fig, 3 Tab, 31 Ref.

Descriptors: *Anaerobic conditions, *Oxygen sag, *Estuaries, Respiration, Seasonal depletion, *Chesapeake Bay, Stratification, Salinity, Seasonal, Organic matter, Nutrients, Dissolved oxygen, Benthos, Productivity.

Summer oxygen depletion in Chesapeake Bay, which was unusually severe in 1976, may adversely affect man's use of these waters for power plant cooling, waste disposal, and recreation. These changes are produced by the spring freshet, which decreases salinity in the upper layers from 1.2-1.5% to 0.5-1.0%, inhibiting oxygen transfer from the surface to the deep layers. Studies of data collected from 1964-77 indicated high oxygen concentrations in December-February, decreasing in March-April to a minimum in June or early July. Deep water oxygen (greater than 10 meters) changes from summer minimum to winter maximum varied from 0.03 to 0.11 ml per liter per day. The major factor affecting oxygen depletion was plankton metabolism. Secondary factors were benthic respiration and organic matter from the previous year. (Cassar-FRC)
W81-03456

LONGITUDINAL CHARACTERIZATION OF A TIDAL MARSH CREEK SEPARATING TWO HYDROGRAPHICALLY DISTINCT ESTUARIES,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
F. B. Schwing, and B. Kjerfve.
Estuaries, Vol 3, No 4, p 236-241, December, 1980. 6 Fig, 2 Tab, 18 Ref.

Descriptors: *Tidal marshes, *Hydrograph analysis, *Water quality, Coastal marshes, *Jones Creek, Nodal points, Winyah Bay, North Inlet, Mixing, South Carolina, Estuaries, Vegetation, Water pollution, Path of pollutants.

Jones Creek, South Carolina, connects 2 very different estuarine systems. North Inlet is a Class C estuary with salinity, 30-34 ppt; average channel depth, 5 m; and annual runoff, 10 cu m per sec. Winyah Bay is a Class B estuary with wider salinity ranges; channel depth, 8 m; and runoff rate, 450 cu m per sec. The water quality in Winyah Bay is reduced due to steel and pulp mills, harbor shipping, and domestic pollution. Computer modeling of 152 sets of hydrographic data from February, 1978 indicate a nodal point in Jones Creek, at which flow between the two systems is limited. Vegetation differences on either side of the node suggest that this node is a permanent feature. On the North Inlet side of the node, water quality is rated SA, safe for shellfish harvesting. Here Spartina alterniflora predominates. On the south Winyah Bay side, water quality is rated SC, unsuitable for direct contact or shellfishing. Vegetation is entirely different from the north side, mixed species being present. This nodal feature may be present in other similar estuarine systems. (Cassar-FRC)
W81-03457

THE INFLUENCE OF WETLAND VEGETATION ON TIDAL STREAM CHANNEL MIGRATION AND MORPHOLOGY,
Maryland Univ., College Park. Dept. of Geography.
D. Garofalo.
Estuaries, Vol 3, No 4, p 258-270, December, 1980. 8 Fig, 4 Tab, 17 Ref.

Descriptors: *Erosion, *Tidal marshes, *Stream erosion, Channel erosion, Meanders, Tidal effects, Vegetation, Wetlands, Coastal marshes, Saline water, Channel morphology, Hydrodynamics, Salt marshes, Root systems.

Photogrammetric techniques were used to determine the average stream channel migration rates of tidal wetland channels, 0.21 meters per year (saline) and 0.32 meters per year (fresh water). Saline channels are more sinuous than freshwater channels. Vegetation with dense root systems growing on the banks causes saline streams to become more entrenched, whereas fresh water channels behave more like channels in mudflats. The higher average meander amplitude in saline channels suggests that erosional characteristics of stream banks containing dense root systems are more important influences than flow velocity or discharge. Conversely, the morphology of fresh water channels is more heavily influenced by the presence of homogeneous materials devoid of root systems and by hydrodynamic factors. Greater erosive forces occur in salt marshes than in fresh tidal marshes, according to ebb and flood discharge data. A poor correlation between rates of stream channel migration and hydraulic stream flow data suggests that under normal conditions, tidal channels migrate little. Storms are believed to be the major cause of stream channel migration. (Cassar-FRC)
W81-03458

DEPENDENCE OF MEAN SPECTRAL EXTINCTION COEFFICIENT OF PHYTOPLANKTON ON DEPTH, WATER COLOR, AND SPECIES,
Rochester Univ., NY. Dept. of Biology.
D. Atlas, and T. T. Bannister.
Limnology and Oceanography, Vol 25, No 1, p 157-159, January, 1980. 2 Fig, 8 Ref.

Descriptors: *Phytoplankton, *Spectral analysis, Water depth, Shallow water, Deep water, Algae, Lakes, Seawater, Eutrophication.

Computer tapes of the values of the spectral extinction coefficient at various water depths were prepared for the green alga Chlorella pyrenoidosa and for the diatom Navicula minima and the blue-green alga Synechocystis sp. For these three algal types the spectral extinction coefficient was nearly the same at the surface. This value increased with depth in blue water, decreased with depth in green water, and changed relatively little in blue-green water. The deviation of the spectral extinction coefficient from the previously estimated value of 0.016 below the surface in green and blue waters may account for discrepancies in the quantum yield of photosynthesis obtained in previous studies. The largest variation was noted with the green alga, ranging from 0.005 at depth in green water to 0.021 or more at depth in blue water. In Crater Lake (blue water) and San Vincente (green water), but not the Gulf of California (blue-green water), the attentuation of total quantum irradiance with depth follows Beer's Law to a close approximation, indicating that phytoplankton absorption of light is a small component of the absorption in the first two water bodies. (Baker-FRC)
W81-03472

SALT MARSH PRODUCTIVITY WITH NATURAL AND ALTERED TIDAL CIRCULATION,
San Diego State Univ., CA. Dept. of Biology.
J. B. Zedler, T. Winfield, and P. Williams.
Oecologia, Vol 44, No 2, p 236-240, January, 1980. 1 Fig, 2 Tab, 24 Ref.

Descriptors: *Salt marshes, *Tidal effects, *Productivity, Water circulation, Algae, Wetlands, Coastal marshes, Saline water, Intertidal areas, Tidal marshes, Estuaries, *California, Aquatic plants, Phytoplankton, Aquatic soils.

The effects of tidal circulation on productivity were investigated in three southern California salt marshes. Tijuana Estuary, relatively undisturbed and well-flushed with sea water, had low net aerial primary productivity of vascular plants, 0.4-1.0 kg per kg meter per year. The Flood Control Channel of the San Diego River, where a riprap dike slows tidal circulation, also had low productivity, 0.6 kg per sq meter per year. Fresh water impounded behind a sand bar in Los Penasquitos Lagoon permitted high productivity, 1.2-2.9 kg per sq meter per year. This lagoon is usually open only in winter and spring and receives ephemeral flushing in summer. Although closure of wetlands increased productivity in this study, it could produce hypersalinity or wide variations in salinity in years of low precipitation, reducing productivity and eliminating some species. Reduced tidal circulation causes a shift from vascular plants to salt marsh algal mat, which is good food for invertebrates. However, in warm weather, the algal mat can produce oxygen deficiency and salinity increases without tidal dilution, leading to fish and shellfish mortality. Total effects of tidal disturbances require further study. (Cassar-FRC)
W81-03511

VERTICAL ZONATION ON ROCKY SHORES IN THE SEVERN ESTUARY,

Bristol Univ. (England). Dept. of Zoology.
C. Little, and L. P. Smith.
Estuarine and Coastal Marine Science, Vol 11, No 6, p 651-669, December, 1980. 7 Fig, 3 Tab, 30 Ref.

Descriptors: *Estuaries, *Zonation, *Distribution patterns, Severn Estuary, Aquatic life, Salinity, Turbidity, Temperature, Vertical distribution, *Algae, Tidal effects, *Invertebrates, Aquatic animals, Aquatic algae, Waves(Water), Limpets, Grazing, *England.

The algae and invertebrates at 9 sites on the shores of the Severn Estuary were examined along transects from shore to water from 1975 to 1978 to determine their zonal patterns. Many observations in the distribution of aquatic life were difficult to explain. Littorina littoralis was most abundant at its uppermost limit in the estuary. Macroalgae were absent low on the shore at all sites. Several other algae species were reduced in areas where conditions appeared favorable for their growth. Some animal species had unexplained upper vertical limits. Fauna was less abundant at the head of the estuary, as expected, and algae showed little direct effect when studied in relation to wave action. Physical and chemical measurements indicated that temperature and salinity fluctuations had no significant effect on vertical distribution of flora and fauna. However, turbidity and tidal effects showed some correlation with distribution. When grazers were removed from given areas in the estuary, succession did not take place as in purely marine locations. Green algae and fucoids did not establish or were much delayed. Limpets were much less mobile in the estuary. Algal recolonization of the rocky shore may depend on spore viability and physical factors affecting settlement of Fucus spores. (Cassar-FRC)
W81-03576

A LABORATORY INVESTIGATION OF HEAVY METAL ADSORPTION ON MARINE DREDGE SPOILS,
Smith Coll., Northampton, MA. Dept. of Chemistry.
D. A. Stern, and C. L. Grant.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 2, p 213-218, 1981. 1 Tab, 10 Ref.

Descriptors: *Heavy metals, *Adsorption, *Dredging, Sand, Gravel, Copper, Lead, Cobalt, Nickel, Aquatic life, Estuaries, Zinc, Cadmium, Massachusetts Bay, Spoil banks, Sediment, Seawater.

The rate of heavy metal adsorption onto dredged spoils was investigated as a function of temperature, light levels, and dissolved oxygen content in connection with the sand and gravel mining industry of Massachusetts Bay. A typical dredge spoils sample in sea water was spiked with 100 mg/liter of copper, lead, zinc, cadmium, nickel, and cobalt under conditions of the factorial design. Concentrations of heavy metals remaining in the sea water were determined as a function of time. To obtain information on the rate of adsorption, sampling was conducted at 3, 7, 13, 20, 30, 50, 70, 90, 120, and 180 minutes. In all equilibrium experiments the order of trace metal adsorption was the same, with copper and lead being equally and most extensively adsorbed, followed in order of decreasing adsorption by cadmium, zinc, nickel and cobalt. The least extensively adsorbed metals, cobalt and nickel, may be significantly affected by biological mechanisms which are very slow and would not therefore be observable in this experimental design. Clearly, nickel and cobalt would have a greater potential for aquatic toxicity than would those metals which were adsorbed more quickly. This work suggests that any redistribution of toxic metals brought about by dredging and/or disposal methods would be minimal in an aquatic ecosystem. The rapid and fairly complete adsorption of lead, copper, zinc, and cadmium on natural sediment under most environmental conditions indicates that the concentrations of these metals in the water column will be very small. Sediment appears very effective in scavenging metals from sea water, but this does not remove the toxic potential to the marine environment. (Baker-FRC)
W81-03588

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

RESEARCH AND DEVELOPMENT ON A SPIRAL-WOUND MEMBRANE SYSTEM FOR SINGLE-STAGE SEAWATER DESALINATION,
UOP, Inc., San Diego, CA. Fluid Systems Div.
R. L. Riley, and C. E. Milstead.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-213191, Price codes: A12 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, April, 1981. 211 p, 36 Fig, 101 Tab, 6 Ref, 1 Append. OWRT-C-90277-D(No 9529)(1), 14-34-0001-9529.

Descriptors: *Membranes, *Reverse osmosis, *Desalination, Seawater, Spiral-wound elements, North Carolina, California, Wrightsville Beach(NC), Water Factory 21(CA).

The objective of single-stage seawater desalination by reverse osmosis has been achieved by the development of a thin-film composite poly (ether/urea) membrane, designated TFC-801. This membrane typically exhibits 99.4% rejection with a product flux of 13-15 gal/ft - day operating on seawater at 800 psi applied pressure. A limitation, however, is the membrane's sensitivity to chlorinated feeds. Investigations of the effects of TFC membrane system to various sterilizing agents, biocides, cleaning agents, surfactants, and coagulating agents were conducted, both in the laboratory and in long-term field tests on 4- and 6-in. diameter spiral-wound elements at the OWRT Test Facility at Wrightsville Beach, N.C. Field tests were also conducted on experimental TFC membrane elements at Orange County Water Factory 21, operating on a lime-clarified municipal wastewater feed.
W81-03333

PROCESS FOR ALKALINE SCALING,
CIBA-GEIGY Ltd., London (England).
For primary bibliographic entry see Field 5G.
W81-03404

PROCESS FOR DEMINERALIZING SALINE SOLUTIONS,
ICI Australia Ltd., Melbourne (Australia); and Commonwealth Scientific and Industrial Research Organization, Campbell (Australia). (Assignees).
B. A. Bolto, K. H. Eppinger, and M. B. Jackson.
U.S. Patent No 4,206,051, 4 p, 2 Tab, 8 Ref; Official Gazette of the United States Patent Office, Vol 995, No 1, p 227, June 3, 1980.

Descriptors: *Patents, *Demineralization, *Desalination, *Separation techniques, Saline water, Ion exchange, Resins, Reduction(Chemical), Regeneration, Thermal regeneration.

The invention provides an improvement in the process for the demineralization of a saline solution by thermally regenerable resins. In a first step, the saline solution is treated with a deoxygenating agent and in a second step this deoxygenated saline solution is treated with a thermally regenerable ion exchange resin. The improvement being that the ion exchange resin comprises a component resin derived from a compound selected from a group consisting of N-substituted diallylamines and salts. (Sinha-OEIS)
W81-03527

3C. Use Of Water Of Impaired Quality

EFFECT OF SALINE AND ALKALINE WATER ON GROWTH AND SURVIVAL OF RHIZOBIUM MELILOTI,
New Mexico State Univ., Las Cruces. Dept. of Biology.
J. L. Botsford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209066, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, January, 1981. New Mexico Water Resources Research Institute, New Mexico State University, Report No 130. 24 p, 11 Tab, 7 Ref. OWRT-A-062-NMEX(1).

Descriptors: *Plant growth, *Saline water, *Alkaline water, *Nitrogen fixing bacteria, *Alfalfa, *Arid lands, New Mexico, Brines, Saline water intrusion, Salinity, Soil salinity, Soil types, Water, Alkaline soils, Alkalinity, Bacteria, Arid zones, Arid-zone hydrology, Hydrology.

The objectives of this study were to determine the effects of salts commonly found in water in arid regions on the survival and growth of an agriculturally-important bacterium Rhizobium meliloti (Rm), which converts atmospheric nitrogen into ammonia and lives in symbiotic relationship with alfalfa. Sodium chloride concentrations up to 250 mM did not influence viability of the bacterium suspended in water or soil. A completely-defined low osmolarity growth medium was developed and the effects of adding Na, K, Mg, Cl, phosphate, bicarbonate, sulfate, and acetate ions on the growth rate of various Rm strains was determined. Only Mg, phosphate, and the acetate ions inhibited growth of concentrations of 200 mM or less. Sensitivity to some of the salts was affected byew Mexico were found comparable to laboratory strains regarding salt tolerances. The results of this study suggest salinity in concentrations normally encountered in arid region irrigation water does not influence survival/growth of Rm growing independent of the host plant alfalfa. Work has been extended to determine salinity effects on establishment of the Rm-alfalfa symbiotic relationship that results in biological nitrogen fixation. (Zielinski-IPA)
W81-03267

PROCESS FOR GAS CLEANING WITH RECLAIMED WATER AND APPARATUS FOR WATER RECLAMATION,
Texaco Inc., White Plains, NY. (Assignee).
C. P. Marion, L. E. Estabrook, and G. N. Richter.
U.S. Patent No 4,205,963, 14 p, 2 Fig, 1 Tab, 3 Ref; Official Gazette of the United States Patent Office, Vol 995, No 1, p 200, June 3, 1980.

Descriptors: *Patents, *Reclaimed water, *Water types, Separation techniques, Impaired water use, Recirculated water, Rehabilitation, Industrial water, Equipment, Gas cleaning processes.

Particulate solids, i.e. carbon soot and ash entrained in the how raw gas stream from a partial oxidation gas generator are removed by quench cooling the hot gas stream directly in reclaimed water in a quench drum, or by scrubbing with reclaimed water in a gas scrubbing zone after indirect heat exchange in a gas cooler or both. It is economic to reclaim the water in the dispersion by removing particulate solids and gaseous impurities. The reclaimed water may then be recycled to the gas quench cooling and scrubbing zones. This is done by mixing the dispersion of solids and water together with a liquid extractant. A dispersion comprising particulate carbon, extractant, and a small amount of water is formed and in a decanter separated from a dilute water layer which settles to the bottom of the decanter. Water is removed and introduced on to a stripping plate of a flash column containing at least one stripping plate. The solids-containing water from the decanting zone is flashed below the stripping plate and a portion is converted into steam. The steam passes up through holes or bubble caps in the stripping plate and is dispersed through the water contained on the plate. Unvaporized water falls to the bottom of the column where a vertical weir separates the flash column into two chambers. Solids settle out of the water in the first chamber and clarified water flows over the weir into the second chamber. Overflow water from the bottom stripping plate is discharged below the water-level in the second chamber by way of a downcomer. Reclaimed water is pumped to the gas cooling and scrubbing zones from the second chamber, and waste water

containing solids in the first chamber is discharged. (Sinha-OEIS)
W81-03322

PROCESS FOR GAS CLEANING WITH RECLAIMED WATER,
Texaco Inc., White Plains, NY. (Assignee).
C. P. Marion, L. E. Estabrook, and G. N. Richter.
U.S. Patent No 4,205,962, 16 p, 3 Fig, 1 Tab, 3 Ref; Official Gazette of the United States Patent Office, Vol 995, No 1, p 199-200, June 3, 1980.

Descriptors: *Patents, *Reclaimed water, *Separation techniques, *Recirculated water, Emulsions, Rehabilitation, Industrial water, Distillation, Gas cleaning processes.

Dispersions comprising water and particulate solids are produced in at least one gas cooling or scrubbing zone by quench cooling or scrubbing the raw gas steam from a partial oxidation gas generator with water. The water may be reclaimed by the process. In one embodiment, the carbon-water dispersion containing any ash is mixed with a liquid organic extractand and a liquid aqueous emulsion. The emulsion breaks up, and in a decanting operation a carbon-extractant-water dispersion containing gaseous impurities separates out and floats on a dilute bottoms water layer containing gaseous impurities and some solids. The carbon-extractant-water dispersion is mixed with a heavy liquid hydrocarbon and introduced into a distillation column. The overhead from the distillation column is cooled and separated in a separation vessel into an upper layer of liquid organic extractant, an intermediate layer of aqueous emulsion, a bottom layer of water, and an overhead stream of uncondensed gaseous impurities if any. The liquid aqueous emulsion and the liquid extractant are recycled to the decanting operation. The water layer from the separation vessel and the bottoms water from the decanting operation are separately introduced into a flash column where the water is reclaimed. (Sinha-OEIS)
W81-03323

CONCENTRATIONS OF ELEMENTS IN A MARINE FOOD CHAIN CULTURED IN SEWAGE WASTEWATER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Office of Occupational Health and Safety.
A. K. Furr, T. F. Parkinson, J. Ryther, C. A. Bache, and W. H. Gutenmann.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 1, p 54-59, 1981. 3 Tab, 30 Ref.

Descriptors: *Water reuse, *Aquatic life, *Heavy metals, Wastewater, Domestic wastes, Metals, Accumulation, Bioaccumulation, Copper, Cadmium, Chromium, Nickel, Zinc, Wastewater renovation, Laboratory studies, *Food chains.

In an attempt to learn which elements and organic constituents in treated sewage effluent are absorbed by aquatic species and whether the magnitude of absorption may constitute a hazard to consumers, an aquatic food chain including seaweed, clams, oysters, lobsters, and flounder has been cultured in secondary sewage effluent from the Wareham, Massachusetts treatment plant. Appreciable concentrations of a number of elements may occur in marine organisms exposed to sewage wastewater as compared to the corresponding controls. The study indicated that the accumulation of elemental pollutants by various species may be considerable. Since a major portion of copper, cadmium, chromium, nickel and zinc in municipal wastewater is believed to derive from domestic uses, monitoring metal concentrations in wastewater from domestic as well as industrial sources prior to reuse is recommended. (Baker-FRC)
W81-03426

3E. Conservation In Industry

PROCESS FOR GAS CLEANING WITH RECLAIMED WATER AND APPARATUS FOR WATER RECLAMATION,
Texaco Inc., White Plains, NY. (Assignee).
For primary bibliographic entry see Field 3C.
W81-03322

PROCESS FOR GAS CLEANING WITH RECLAIMED WATER,
Texaco Inc., White Plains, NY. (Assignee).
For primary bibliographic entry see Field 3C.
W81-03323

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

MUNICIPAL WELLS, LAND DEVELOPMENT AND FRESHWATER WETLANDS IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Forestry and Wildlife Management.
D. S. Wilkie, and J. S. Larson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209132, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, October, 1980. Massachusetts Water Resources Research Center, University of Massachusetts, Publication No 120. 32 p, 1 Fig, 21 Tab, 3 Ref, 1 Append. OWRT-A-121-MASS(1), 14-34-0001-9023.

Descriptors: *Municipal water, *Massachusetts, *Water supply, *Wells, *Land development, *Wetlands, Aerial photography, Photography, Well water, Water, Water table, Remote sensing, Vegetation, Maps, Topographic mapping, Mapping, Agriculture, Runoff, Construction, Water use, Water surface profiles, Profiles.

The objective of this study was to determine whether existing data on water demand, land use and wetland change, and groundwater yield were adequate to detect and measure the impact of land use change and increased water demand on freshwater wetlands. Records of municipal wells and aerial photogrammetric data were examined to determine whether well pumping and land development affect freshwater wetlands in 14 Massachusetts towns. Existing aerial photography and related maps accurately detect changes in freshwater wetlands. Highway/industrial/commercial/business/residential construction represent the most important wetland loss causes. Agriculture, and sand and gravel operations, cause both losses and gains in wetlands. There was no detectable change in wetland vegetation in a one-half mile radius around municipal wells where pumping rates were high. Man-induced change in wetlands around wells was slight; water pumping apparently has not caused marked wetlands change. Municipal well records were poorly kept and surficial geologic mapping was lacking in most areas; these factors may have prevented detection of some lesser wetland vegetation change level. (Zielinski-IPA)
W81-03256

SUMMARY OF TECHNICAL CONCLUSIONS TO 1979.
Melbourne and Metropolitan Board of Works (Australia).
For primary bibliographic entry see Field 6D.
W81-03282

OAK TREES AND LIVESTOCK - MANAGEMENT OPTIONS,
California Univ., Hopland. Hopland Field Station.
A. H. Murphy.
In: Proceedings of the Symposium on the Ecology, Management, and Utilization of California Oaks, June 26-28, 1979, Claremont, California. Forest Service, Pacific Southwest Forest and Range Experiment Station, Berkeley, California, General Technical Report PSW-44, November, 1980, p 329-332. 11 Ref.

Descriptors: *Range management, *Oak trees, *Water yield, *Runoff, Erosion rates, Channel scour, Storm seepage, Surface runoff, Forages, Grazing, Grasses, Legumes, Land management, California.

In California, approximately 10 million acres of woodland-grass type offer opportunities for modification of the tree cover to improve their [illegible] in livestock management. In order to determine the effects of tree removal on rangeland, two watershed areas (210 and 60 acres) had water yield, runoff, erosion, forage, and livestock data collected, during three test periods; pre-treatment, treatment, and post-treatment. The pre-treatment period represented the watershed condition before any changes were applied. The treatment period involved reduction of trees and shrubs by cutting, chemical treatment, and fire followed by seeding of grasses and legumes. The final phase was evaluation of treatments by the collection of hydrologic data, sheep grazing use, and forage production. Before treatment the average grazing capacity was 50 animal unit months (AUM); following conversion from woody cover to herbaceous cover, it increased to 300 AUM. Benefits derived from tree removal also included an increase of water yield either by surface or sub-surface flow. If a large percentage of the trees are killed, under some geologic situations erosion will increase in terms of channel scouring as well as by land slips. (Moore-SRC)
W81-03312

SUCTION DEVICE FOR CLEANING BOTTOMS OF WATERWAYS AND FOR LIFTING SUNKEN TIMBER,
L. O. Niskala.
U.S. Patent No 4,207,690, 8 p, 10 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 995, No 3, p 806, June 17, 1980.

Descriptors: *Patents, *Channel improvement, *Stream improvement, Equipment, Cleaning, Suction devices, Debris.

A suction device for clearing the bottom of waterways includes a suction end having an inlet opening. Mounted to the horizontal edges of the inlet opening are either force-driven conveyor screws or triangular flanges, with rollers mounted on the vertical edges of the inlet opening. The rollers in cooperation with either the triangular flanges or the conveyor screws turn material snagged in the waterway endwise into a suction pipe terminating at the suction end. Debris sucked into the suction pipe is delivered to a load basket at the other end of the suction pipe. The loading basket is constructed for lifting from the water by means such as a crane, and further constructed for unloading from the bottom. (Sinha-OEIS)
W81-03377

4B. Groundwater Management

TRACING GROUND-WATER MOVEMENT BY USING THE STABLE ISOTOPES OF OXYGEN AND HYDROGEN, UPPER PENITENCIA CREEK ALLUVIAL FAN, SANTA CLARA VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
K. S. Muir, and T. B. Coplen.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.25. Geological Survey Water-Supply Paper 2075, 1981. 18 p, 4 Fig, 3 Tab, 18 Ref.

Descriptors: Groundwater, *Groundwater movement, *Oxygen, *Hydrogen, Imported water, Artificial recharge, *Tracers, Stable isotopes, Wells, Pumping, Sampling runoff, Geohydrology, *California, *Santa Clara Valley, Penitencia Creek alluvial fan.

Starting in 1965 the Santa Clara Valley Water District began importing about 100,000 acre-feet per year of northern California water. About one-half of this water was used to artificially recharge the Upper Penitencia Creek alluvial fan in Santa

Clara Valley. In order to determine the relative amounts of local ground water and recharged imported water being pumped from the wells, stable isotopes of oxygen and hydrogen were used to trace the movement of the imported water in the alluvial fan. To trace the movement of imported water in the Upper Penitencia Creek alluvial fan, well samples were selected to give areal and depth coverage for the whole fan. The stable isotopes of oxygen-16, oxygen-18, and deuterium were measured in the water samples of imported water and from the wells and streams in the Santa Clara Valley. The isotopic data indicate dilution of northern California water with local ground water in a downgradient direction. Two wells contain approximately 74 percent northern California water, six wells more than 50 percent. Data indicate that there may be a correlation between the percentage of northern California water and the depth or length of perforated intervals in wells. (USGS)
W81-03271

IRRIGATION BENEFITS,
Department of Agriculture, Ashburton (New Zealand). Winchmore Irrigation Research Station.
For primary bibliographic entry see Field 6B.
W81-03529

DESIGN TOOL AIDS GROUNDWATER MANAGEMENT,
Science and Education Administration, Fresno, CA. Water Management Research.
For primary bibliographic entry see Field 6A.
W81-03536

4C. Effects On Water Of Man's Non-Water Activities

INVESTIGATION OF SOIL CONSERVATION SERVICE URBAN HYDROLOGY TECHNIQUES,
Espey, Huston and Associates, Inc., Austin, TX.
For primary bibliographic entry see Field 2E.
W81-03317

TRRL AND UNIT HYDROGRAPH SIMULATIONS COMPARED WITH MEASUREMENTS IN AN URBAN CATCHMENT,
Water Research Centre, Marlow (England).
For primary bibliographic entry see Field 2A.
W81-03435

4D. Watershed Protection

AT PORTLAND: TEAM EFFORTS MAINTAIN WATERSHED.
Water/Engineering and Management, Vol 128, No 2, p 8, 82, February, 1981.

Descriptors: *Water quality, *Watershed management, Forest watersheds, Interagency cooperation, Governmental interrelations, Planning, Regional planning, Long-term planning, *Portland, Oregon, Metropolitan water management, Public participation.

The Portland, Oregon, Water Bureau maintains the factors needed for successful management of its watershed, including a commitment among its managers to work with other agencies, a staff capable of handling a variety of disciplines, good planning and execution of engineering projects within the watershed, and use of the most up-to-date surveillance methods and equipment. Since the quality of the water supply at its source is excellent, maintaining the quality of the water at the watershed is a prime concern of the utility's management. Public Law 95-200, which controls the management of Portland's Bull Run watershed area, assigns responsibility for the integrity of the watershed to the U.S. Forest Service, while responsibility for determining whether water quality standards are met is assigned to the Water Bureau. The Bureau staff includes such non-engineering professionals as agronomists, land use managers, and forestry experts. Interdisciplinary teams are used for internal planning. Communications between the utility and the public are encouraged through an aggressive public information program, citizen advisory committees, and public attitude surveys. Emphasis is placed on long-term successes and goals rather than on short-term results. (Carroll-FRC)
W81-03600

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

QUANTIFICATION OF NON-POINT SOURCE SEDIMENTATION THROUGH DENSITOMETRIC ANALYSIS OF COLOR INFRARED AERIAL PHOTOGRAPHY,
Sewall (James W.), Co., Old Town, ME.
For primary bibliographic entry see Field 5B.
W81-03252

ULVA LACTUCA AS A BIOINDICATOR OF COASTAL WATER QUALITY,
Massachusetts Univ., Amherst. Dept. of Botany.
H. G. Levine, and R. T. Wilce.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209140, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, 1980. Massachusetts Water Resources Research Center, University of Massachusetts, Publication No 119. 83 p, 17 Fig, 10 Tab, 57 Ref. OWRT-A-112-MASS(1), 14-34-0001-8023.

Descriptors: *Sea grasses, *Water quality, *Bioindicators, Bioaccumulation, *Coastal waters, Water pollution, Aquatic plants, Indicators, *Pollutant identification, Accumulation, Biological magnification, Water, Monitoring, Pollution load, Pollutants, Polychlorinated biphenyls, Hydrocarbons, Gas chromatography, Chemical analysis, Water analysis.

A study was conducted to develop methods that capitalize on the capacity of the green alga Ulva lactica L. (Ulva), known as Sea Lettuce, to function as a bioindicator for coastal waters. Preliminary studies evaluated growth of Ulva discs and germlings as related to physical parameters (monitoring coastal water nutrient load) in the environment. A number of observed nonuniformity factors reduced the feasibility of using a disc monitoring method. Use of genotypically identical germlings, on the other hand, proved to be a successful approach. Germlings were used as in situ assay organisms under diverse ecological conditions, with the unit of measurement related to germling growth. The ability to characterize Ulva germling growth relative to physical/chemical parameters operating in the environment was demonstrated. Use of Ulva as a bioaccumulator of water pollutants was also studied by gas chromatographic analysis of Ulva tissue samples from different Massachusetts populations. Polychlorinated biphenyls (PCBs) and saturated hydrocarbons were observed in New Bedford and Hingham Harbor populations, respectively. (Zielinski-IPA)
W81-03254

IDENTIFICATION OF THE WATER QUALITY FACTORS WHICH PREVENT FINGERNAIL CLAMS FROM RECOLONIZING THE ILLINOIS RIVER, PHASE II,
Illinois Natural History Survey, Havana. River Research Lab.
R. E. Sparks, M. J. Sandusky, and A. A. Paparo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209116, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois, Urbana, Research Report 157, March, 1981. 52 p, 20 Fig, 6 Tab, 25 Ref. OWRT-B-119-ILL(9), 14-34-0001-9069.

Descriptors: *Water pollution effects, *Bioassay, *Bioindicators, *Bivalves, *Illinois River, Water quality, Musculium transversum, Sediment, Filtration, Toxicity, Clams, *Fingernail clams.

Fingernail clams disappeared from the middle Illinois River during the 1950s and have not returned. There are residual populations of clams in lakes and tributary streams, indicating that whatever factors caused the initial die-off must be preventing recolonization. Earlier phases of this study had developed methods of maintaining the clams in the laboratory and of rapidly assessing the toxicity of substances to the clams (by counting beating rates of cilia on isolated pieces of gill). In this phase, both sediment and water from affected parts of the river inhibited the ciliary beating rate. Deletion studies (in which the survival rates of intact clams in river water treated to remove toxic substances) showed that the highest mortalities occurred in untreated river water. The next highest mortalities occurred in river water that had been filtered through sand only, while there was no significant difference in mortality between the well water controls. Although the specific toxic factor(s) have not yet been identified, the rapid assay (using clam gills) and the deletion bioassay (selectively removing toxic components from test water) are promising means of identifying effective treatments for complex wastes and polluted streams. Once the toxicants are known, recommendations may be made to environmental protection agencies for control of the toxic materials, for restoration of detritus-based food webs in the Illinois River, and for the prevention of such problems in other midwestern rivers.
W81-03257

STREAM MONITORING FOR HEAVY METALS BY ANALYSIS OF AQUATIC INSECT LARVAE,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
C. M. Weiss, R. P. Maas, and S. A. Dressing.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209082, Price codes: A08 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina, Raleigh, Report No 162, January, 1981. 140 p, 39 Fig, 29 Tab, 41 Ref, 8 Append. OWRT-A-095-NC(3), 14-34-0001-8035.

Descriptors: Insects, Caddisflies, Metals, Cadmium, Chromium, Zinc, Monitoring, Indicators, *Pollutant identification, *Heavy metals, *Aquatic insects, *North Carolina, Rivers, Streams, Bioindicators, Midgefly, Biological monitoring.

The potential of aquatic insects for monitoring heavy metals in North Carolina streams and rivers was investigated. The caddisfly, Hydropsyche sp. and the midgefly, Chironomus sp., both common in North Carolina Rivers, were exposed to a wide range of aqueous cadmium, chromium and zinc concentrations under laboratory and field conditions. The rates of accumulation and loss of the test metals as well as the equilibrium metal concentrations in the test species at a given metal exposure level were determined. The effects of other biological and chemical factors including water temperature, chemical speciation of the metals, concentrations of competing metals, sediment metal concentrations and organism weight on the metal accumulation of the organisms were also evaluated. Chironomus sp. was found to accumulate all three metals to a greater extent than Hydropsyche sp., although a strong linear relationship was noted between aqueous and organism metal concentrations over the concentration range used for both organisms. Metal equilibrium between organisms and water was attained with one to three days in all cases. Equilibrium organism metal concentrations increased with increasing water temperature for a given aqueous metal concentration. The rate of metal release following transfer of exposed organisms to metal free water was significantly slower for Hydropsyche sp. This characteristic would indicate a greater utility of Hydropsyche sp. for stream metal monitoring. Elevated organism metal concentrations were observed for 3 to 12 days following exposure depending on organism species and metal exposure level.
W81-03258

COMPARING THREE WATER QUALITY SAMPLING TECHNIQUES FOR MEASURING NON-POINT SOURCE POLLUTION IN FOREST STREAMS,
Arkansas Univ., Fayetteville. Dept. of Forest Resources.
R. S. Beasley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209199, Price codes: A02 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, University of Arkansas, Project Completion Report, March 27, 1981. 11 p, 1 Fig, 1 Tab, 12 Ref. OWRT-A-049-ARK(1).

Descriptors: Water quality, *Water sampling, *Nonpoint pollution sources, *Forest watersheds, *Suspended solids, *Storm runoff, Water quality control, Quality control, Sampling, Water analysis, Sample preparation, Pollution load, Watersheds, Sedimentation, Suspended load, Storm water, Storms, Runoff, Catchment areas, Basins.

This study compared two of the most common types of stream sampling systems: Coshocton wheel samplers with proportional splitters; and pumping samplers. Comparisons were based upon concentrations of total suspended solids (TSS), determined by vacuum filtration through 0.45 micron filters and the evaporation method, and expressed as mg/liter concentrations. Nine forested experimental watersheds in the Ouachita Mountains in central Arkansas were equipped with 0.9 meter H-plumes, concrete wing walls and approach sections, water stage recorders, Coshocton wheel samplers, sediment traps, water splitters, and a network of rain gages. Mean TSS for six storms was 106 and 31 mg/liter for Coshocton and pumping samplers, respectively. Deletion of questionable TSS values for one of the storms resulted in mean TSS values of 47 and 34 mg/liter, and 617 and 442 kg total sediment losses, for Coshocton and pumping samplers, respectively. The study is continuing to more fully evaluate comparative performances of these two sampling systems, including a third type, single stage samplers, as well. (Zielinski-IPA)
W81-03268

BIOMONITORING OF EFFLUENTS IN PERSPECTIVE,
Environmental Research Lab., Duluth, MN.
D. I. Mount.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-202237, Price codes: A06 in paper copy, A01 in microfiche. In: Proceedings of the Seminar on Biological Monitoring and Its Use in the NPDES Permit Program, October 2, 1979, Chicago, Illinois, Environmental Protection Agency Report, EPA-600/9-026, May, 1980, p 3-7.

Descriptors: *Bioassay, *Monitoring, *Toxicity, *Aquatic life, *Environmental effects, Testing procedures, Pollutants, Effluents, Sampling.

Biomonitoring of aquatic environments is used to determine the toxicity of substances directly with organisms, which cannot be achieved by chemical and electronic testing. For complex organic chemicals biomonitoring can be cheaper than chemical testing, although as understanding improves, chemical measurements can be more effectively correlated with toxicity, and these tests will always remain useful. Other advantages of biomonitoring are that it more closely approximates the receiving conditions than other tests, it can use mixtures for testing, and it measures the response of the target organism, rather than an index of it. Tests conducted in laboratories produce results which can be extrapolated to the problems of pollution in real-life situations. Biomonitoring is less effective in measuring chronic effects, and the persistence of chemicals. For effective testing, samples must be representative of the effluent. (Brambley-SRC)
W81-03299

THE NPDES PERMIT POLICY AS IT RELATES TO BIOMONITORING,
Environmental Protection Agency, Chicago, IL. Enforcement Div.
S. Gardebring.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-202237, Price codes: A06 in paper copy, A01 in microfiche. In: Proceedings of the Seminar on Biological Monitoring and Its Use in the NPDES Permit Program, October 2, 1979, Chicago, Illinois, Environmental Protection Agency Report, EPA-600/9-80-026, May, 1980, p 8-19.

Descriptors: *Bioassay, *Monitoring, *Legislation, Chemical industry, Effluents, Water quality standards, Water pollution control, Water pollution prevention, Bioaccumulation.

Biomonitoring, when combined with process evaluation and chemical analysis, can be a potent tool both for discovering and limiting the discharge of toxic substances, which is how the EPA plans to use it. EPA authority for requiring biomonitoring stems from Section 308 of the Clean Water Act, and the states must have similar authority in order to receive NPDES authority. Biomonitoring will be required of major dischargers, especially chemical-based industries, and of minor dischargers if evaluation of the facility, process, and treatment suggest the liklihood of toxic discharges. Major emphasis will be placed on discharges to the Great Lakes and their tributaries. State water quality standards will be used to develop permit limits for toxic substances, but where biomonitoring shows that a substance at levels below the standard is bioaccumulated by organisms or is carcinogenic, teratogenic, or mutagenic, new lower standards will be required. Industries are recommended to begin testing so that they will have information and time to make changes if they are deemed necessary, rather than waiting for enforcement actions. (Brambley-SRC)
W81-03300

STATIC TEST USING FISH,
Environmental Protection Agency, Wheeling, WV. Wheeling Field Office.
R. Preston.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-202237, Price codes: A06 in paper copy, A01 in microfiche. In: Proceedings of the Seminar on Biological Monitoring and Its Use in the NPDES Permit Program, October 2, 1979, Chicago, Illinois, Environmental Protection Agency Report, EPA-600/9-80-026, May, 1980, p 20-24.

Descriptors: *Fish, *Bioassay, *Testing procedures, *Toxicity, Variability, Quality control, Water pollution effects, Pollutants, Fathead minnows, Catfish, Bluegills, Trout.

The static bioassay is a nondynamic test consisting of a solution of a mixture, with test organisms placed in it, left for a specified period of time to observe the response of the organisms. The test is cheap and simple, but has the disadvantages of possible changes in the toxic substance, due to volatility, degradation, adsorption, or uptake by the organisms. Fish bioassays frequently use fathead minnows as they can be cultured to reduce the variables that would be present in wild fish; channel catfish and blue gills are possible test fish, as are trout if cold water fish are required. Strict quality controls are necessary if the validity of the test is to be assured. Maintenance of a healthy stock of fish, a well-designed laboratory, inert containers for fish, thorough cleaning of containers between tests, acceptable dilution water and dissolved oxygen levels are factors to be considered. A list of the items that should be in the report of the static bioassay is presented. (Brambley-SRC)
W81-03301

STATIC TEST USING ALGAE,
Corvallis Environmental Research Lab., OR.
W. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-202237, Price codes: A06 in paper copy, A01 in microfiche. In: Proceedings of the Seminar on Biological Monitoring and Its Use in the NPDES Permit Program, October 2, 1979, Chicago, Illinois, Environmental Protection Agency Report, EPA-600/9-80-026, May, 1980, p 25-30. 1 Tab, 11 Ref.

Descriptors: *Bioassay, *Algae, *Selenastrum, *Pollutants, Electronic equipment, Growth, Productivity, Heavy metals, Textile mill wastes, Limiting nutrients, Industrial wastes.

A static bioassay using the unicellular green alga Selenastrum capricornutum has been developed. An electronic particle counter is used to measure cell density and mean cell volume changes within the cells during the growth period, which are used in a calibration curve corresponding to dry weight. The test has been used to predict productivity in lakes, the effects of heavy metals, and evaluate the toxic properties of waste samples from textile manufacturing processes. For the textile wastes the algal bioassay proved to be one of the most sensitive out of seven assay techniques using freshwater and marine algae, crustacea, fish, and mammals. The Selenastrum bioassay not only identified toxic wastes but stimulatory ones. This test is a viable tool for the study of nutrient limitation and heavy metal toxicity and shows great potential for the evaluation of complex wastes. The validation of the test to define its sensitivity to broad classes of industrial wastes is an important task, hindered by the lack of evaluation of the toxic and/or stimulatory effects of organic compounds. (Brambley-SRC)
W81-03302

FLOW-THROUGH TEST USING FISH,
Environmental Research Lab., Athens, GA.
W. Peltier.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-202237, Price codes: A06 in paper copy, A01 in microfiche. In: Proceedings of the Seminar on Biological Monitoring and Its Use in the NPDES Permit Program, October 2, 1979, Chicago, Illinois, Environmental Protection Agency Report, EPA-600/9-80-026, May, 1980, p 31-39. 3 Fig, 2 Ref.

Descriptors: *Bioassay, *Fish, *Toxicity, *Testing procedures, Water quality standards, Bioaccumulation, Monitoring, Effluents, Bacteria, Water pollution control.

An intermittent flow-through test system is described which uses a total solenoid system for proportional dilution. Flow-through tests are used for acute toxicity testing with fish, invertebrates, algae, and bacteria, for longer term and chronic testing. Testing has been used to establish safe limits or no effects limits for chemicals such as pesticides and heavy metals, and can be used for testing of mixtures of chemicals, bioaccumulation of chemicals by organisms, and on-line monitoring of effluents. The advantages of flow-through testing systems are: acute or chronic tests can be conducted; ease of maintenance of DO levels; metabolic wastes are removed; ease of achieving a steady-state chemical concentration; and ability to detect slug discharges. The disadvantages are the high degree of technical skill and equipment sophistication, large amounts of dilution water and space required, and the cost. Two rapid flow-through test systems designed for monitoring purposes, using bacteria, have been undergoing evaluation. (Brambley-SRC)
W81-03303

BIOCONCENTRATION TESTS FOR EFFLUENTS,
Environmental Research Lab., Duluth, MN.
G. D. Veith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-202237, Price codes: A06 in paper copy, A01 in microfiche. In: Proceedings of the Seminar on Biological Monitoring and Its Use in the NPDES Permit Program, October 2, 1979, Chicago, Illinois, Environmental Protection Agency Report, EPA-600/9-80-026, May, 1980, p 40-46. 2 Fig.

Descriptors: *Bioassay, *Bioaccumulation, *Fish, *Biological magnification, Biological sampling, Pollutants, Partition coefficient, Physical properties, Effluents.

Bioconcentration is the component of bioaccumulation which results when fish accumulate a chemi-

cal through the gills to a concentration higher than that of the water. The bioconcentration test is conducted by using fish such as fathead minnows in an aquarium, adding the chemical or effluent on a continuous basis, and composite sampling of fish at 2, 4, 8, 16, and 32 days for analysis. There is a rapid initial uptake followed by a slower rate and finally a relatively constant residue concentration. This point is called the steady-state concentration for the exposure and the bioconcentration factor is calculated by dividing the steady-state residue by the water concentration. The bioconcentration factor is constant over a wide range of water concentrations, so the steady-state residue in fish can be calculated knowing the water concentration. A 30-day test is sufficient to determine bioaccumulation potential, though the steady-state may not be reached in this time. The n-octanol/water partition coefficient can be related to the bioconcentration factor: the higher the coefficient, the greater the possibility of accumulation. For use as a screening test, substances with partition coefficients below 1000 may be considered as unimportant from a bioaccumulation viewpoint. (Brambley-SRC)
W81-03304

SEDIMENT BIOASSAY,
Environmental Protection Agency, Chicago, IL. Central Regional Lab.
M. Anderson, and B. Prater.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-202237, Price codes: A06 in paper copy, A01 in microfiche. In: Proceedings of the Seminar on Biological Monitoring and Its Use in the NPDES Permit Program, October 2, 1979, Chicago, Illinois, Environmental Protection Agency Report, EPA-600/9-80-026, May, 1980, p 47-61. 9 Fig.

Descriptors: Bioassay, *Bottom sediments, *Testing procedures, Rivers, Lakes, *Aquatic animals, Toxicity, Environmental effects, Harbors, Pollutants, Solid waste disposal, Dredging.

Sediment bioassays are conducted in a closed-cycle sediment bioassay apparatus adapted from an original design, and using a 10 gal. tank with two gal. tanks. The units can be arrayed in pairs or series for multiple tests. The apparatus has been used to determine sediment effects in riverine systems and lakes. A river system test was conducted to determine 96 h toxicity of sediments on Hexagenia limbata, Asellus communis, and Daphnia. The toxicities of the sediments were such that it appeared that reduction of a thermal discharge might result in no improvement in the river habitats. The apparatus has also been used to determine toxicity of harbor sediments and provide indications for the disposal of dredged material. If pollution is not severe, the dredged material may be disposed of in the open lake; severely polluted material requires secure land disposal. Useful information is being obtained from the test but refining is needed to improve its replicability. (Brambley-SRC)
W81-03305

TENTATIVE GUIDELINES FOR FLOW-THROUGH EARLY LIFE STAGE TOXICITY TESTS WITH FATHEAD MINNOWS FOR USE IN THE U.S. EPA, OTS-ORD ROUND ROBIN TEST,
Environmental Research Lab., Duluth, MN.
D. I. Mount.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-202237, Price codes: A06 in paper copy, A01 in microfiche. In: Proceedings of the Seminar on Biological Monitoring and Its Use in the NPDES Permit Program, October 2, 1979, Chicago, Illinois, Environmental Protection Agency Report, EPA-600/9-80-026, May, 1980, p 62-68. 4 Ref.

Descriptors: *Bioassay, *Testing procedures, *Fish, *Fathead minnows, *Toxicity, Embryonic growth stage, Larval growth stage, Growth stages, Statistical analysis, Hatching, Survival, Weight, Pollutants.

A draft protocol is presented for estimation of chronic toxicity in the embryo-larval stages of fathead minnows. Changes will be made before the test is made final. The organisms are examined for statistically significant reductions in percent hatch, percent survival, and weight, in order to determine upper and lower chronic values. The following parameters are specified: toxicant concentration; a solvent control (if necessary), test chamber dimensions; fish numbers; embryo cups; dilution water; photoperiod; temperature; dissolved oxygen; and flow rate. Test procedures are described for selection and placement of embryos, feeding, cleaning of tanks, recording of temperature, dissolved oxygen, water hardness, pH, acidity and alkalinity, and toxicant concentration. Guidance is given on the acceptability of tests on a statistical basis, and on the statistical analysis of the test results. (Brambley-SRC)
W81-03306

EFFLUENT GUIDELINES LIMITATIONS AND LETHAL UNITS,
EG and G, Bionomics, Inc., Wareham, MA.
K. J. Macek.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-202237, Price codes: A06 in paper copy, A01 in microfiche. In: Proceedings of the Seminar on Biological Monitoring and Its Use in the NPDES Permit Program, October 2, 1979, Chicago, Illinois, Environmental Protection Agency Report, EPA-600/9-80-026, May, 1980, p 69-79. 4 Tab.

Descriptors: *Bioassay, *Toxicity, *Effluents, *Monitoring, Industrial wastes, Influent streams, Sampling, Fathead minnows, Daphnia, Pulp wastes, Pesticides.

The 'toxic unit' is a unitless measure of toxicity which can be used to represent relative toxicity of effluents. A mass emission rate per unit time can be calculated from the toxic unit if the flow rate of the effluent is known. The toxic unit is a test-specific parameter, so standard, reproducible tests are required if the toxic unit is to be used in water quality management decisions. Tests were conducted at seven industrial sites to determine: the efficacy of treatment systems for removing toxicity in industrial wastes; the variability in toxicity of influent and effluents; the required frequency of sampling for enforcement and compliance monitoring; and the effect of species selection. Tests were conducted with fathead minnows and Daphnia magna. In wastes from a paper mill and an organic chemical plant both species indicated 0 toxic units in the effluent. In the remaining plants, all pesticide manufacturing plants, the toxic units for minnows were 1.2-6 and for Daphnia 1.3-4.4, with relative standard deviations of 4 - 26% and 9 - 22%, respectively. The utility of toxicity tests is considered to be in providing data for establishing the permit conditions relative to toxicity, but for monitoring purposes a physical or chemical parameter which can be correlated to, or is indicative of, changes in toxicity, should be measured. (Brambley-SRC)
W81-03307

APPLICABILITY OF THE AMES TEST IN BIOMONITORING,
Health Effects Research Lab., Research Triangle Park, NC. Environmental Toxicology Div.
L. Claxton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-202237, Price codes: A06 in paper copy, A01 in microfiche. In: Proceedings of the Seminar on Biological Monitoring and Its Use in the NPDES Permit Program, October 2, 1979, Chicago, Illinois, Environmental Protection Agency Report, EPA-600/9-80-026, May, 1980, p 80-94. 5 Fig, 6 Tab.

Descriptors: *Bioassay, *Testing procedures, *Salmonella, *Monitoring, Effluents, *Pollutant identification, Hazardous materials, Water pollution control, Pollutants, Toxicity.

The Ames test is a rapid, inexpensive test for genotoxicity using Salmonella typhimurium. It can be coupled with chemistry, technology and other tests in order to direct the development of technology and help those who are in technology development to determine the hazardous materials in a system. The test procedure is described and the essential equipment listed. The bacterial response in the test may be positive, negative or questionable. The questionable response may result from the toxicity of the test substance or a very irregular response. Replicate experiments can clarify the responses. Aqueous effluents need preliminary treatment such as concentration, extraction, fractionation, or particulate removal before they can be tested. Modifications of the Ames test, suitable for specific research needs, are the spot test, the liquid suspension test, the preincubation test, and the well test. (Brambley-SRC)
W81-03308

RAPID ASSESSMENT METHODS, (FISH COUGH RESPONSE, ETC.),
Environmental Research Lab., Duluth, MN.
R. Drummond.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-202237, Price codes: A06 in paper copy, A01 in microfiche. In: Proceedings of the Seminar on Biological Monitoring and Its Use in the NPDES Permit Program, October 2, 1979, Chicago, Illinois, Environmental Protection Agency Report, EPA-600/9-80-026, May, 1980, p 95-96. 11 Ref.

Descriptors: *Bioassay, *Fish, *Respiration, *Monitoring, *Effluents, Fish behavior, Pollutants, Computers, Data processing, Water pollution control, Pollutant identification.

Ten recent publications are cited which are primarily concerned with fish as a tool for the biomonitoring of effluents. Five behavioral endpoints meet the criteria of expense, simplicity, and relevance to the animals ability to live and function properly which make them appropriate for testing. They are: reproductive habits; feeding patterns/habits; fear responses; the righting reflex; and respiration. Numerous toxic substances affect fish respiration rates and the response is usually developed rapidly. The response is related to the concentration. The test is adaptable to both flow-through and recirculating bioassays, and the data can be collected, tabulated, and analyzed automatically using computers or other automatic data processing devices. These tests provide an effective screening procedure to identify effluents which need further testing. (Brambley-SRC)
W81-03309

TEST ORGANISM ACQUISITION AND CULTURING IN THE LAB,
Environmental Protection Agency, Chicago, IL. Central Regional Lab.
C. Steiner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-202237, Price codes: A06 in paper copy, A01 in microfiche. In: Proceedings of the Seminar of Biological Monitoring and Its Use in the NPDES Permit Program, October 2, 1979, Chicago, Illinois, Environmental Protection Agency Report, EPA-600/9-80-026, May, 1980, p 97-106. 3 Tab, 3 Ref.

Descriptors: *Bioassay, *Culturing techniques, *Cultures, *Fish, *Invertebrates, Fish food, Contamination, Cost-benefit analysis, Laboratory equipment, Aquatic environment.

When biomonitoring tests are conducted, a source of test organisms in which as many variables as possible are controlled is required, with an ideal of the test material as the only variable. The achievable goal is to provide test organisms which are healthy, relatively free of pollutants, of known age, physiologically representative of the species, and a culture environment which does not cause stress. Organisms may be reared in the laboratory, obtained from a hatchery, or collected from the wild. This last is the least satisfactory because of the unknown status of the organisms, but with the exception of Daphnia is the only source for invertebrates. The advantages and disadvantages of rearing fish and obtaining them from a hatchery are discussed. Rearing a continuous supply of fish is considered to be most satisfactory, given the initial costs and additional staff for culture mainte-

nance. Recommended freshwater, estuarine, and marine species and test temperatures are listed, as are the prophylatic procedures conducted when fish are obtained from outside sources, and organic contaminants that have been found in fish diets. (Brambley-SRC)
W81-03310

BIOLOGICAL MONITORING OF TOXIC TRACE ELEMENTS,
D. W. Jenkins.
Environmental Protection Agency Project Summary, EPA-600/S3-80-090, February, 1981. 10 p, 9 Tab.

Descriptors: *Monitoring, *Trace elements, *Bioaccumulation, *Water pollution, Heavy metals, Toxicity, Biological magnification, Antimony, Arsenic, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Nickel, Selenium, Tin, Vanadium.

The contamination of plants, animals and humans by toxic trace elements poses a continuing and increasing threat to our environment. Of 20 trace elements known to be toxic, 14 are particularly noxious because of their widespread production and use, and subsequent discharge and persistence in the environment. These 14 elements of particular concern are antimony, arsenic, beryllium, boron, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, tin, and vanadium. If biological organisms are used for monitoring, they provide important data about, and actual responses to, pollutant exposure. Both plants and animals can serve as biological monitors for showing changes in levels of pollution and environmental contamination, and as reference points for determining direct or indirect effects on humans. All elements, except antimony and beryllium, are concentrated by some biological organisms present in the environment. Suitable organisms for biological monitoring should: accumulate various elements, be common, be geographically widespread, be easily collected and of adequate size, occur in impacted and unpolluted areas, and show a correlation with environmental levels of trace elements. It is recommended that the National Environmental Pesticide Monitoring Networks program establish and implement monitoring that with assess the exposure to metals considered to have a high priority. (Moore-SRC)
W81-03331

DEVELOPMENT OF A SOLID WASTE LEACHING PROCEDURE AND MANUAL,
Battelle Columbus Lab., OH.
B. C. Garrett, M. M. McKown, M. P. Miller, R. M. Riggin, and J. S. Warner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 9-17. 1 Fig, 2 Tab, 20 Ref. 68-03-2970.

Descriptors: *Leaching, *Testing procedures, *Assay, *Landfills, *Solid wastes, Leachates, Sampling, Particle size, Particle shape, Solid waste disposal, Pollutant identification.

Laboratory procedures for extracting or leaching a sample of solid waste are necessary so that leachate quality from landfills may be predicted. The leaching procedure must be applicable to a wide variety of wastes, and the laboratory manual is intended to give guidance in identifying and understanding the critical aspects of the waste leaching procedure to persons of different backgrounds and training. The critical factors in a leaching procedure are the leaching medium composition, specifically, the proton and electron environment and the presence of solubilizing agents, and the leaching test conditions. Test conditions have been developed for: collecting representative samples; the leaching medium; the solid to liquid ratio; the time per leaching; the number of leachings; the temperature; the mixing technique; and the sample particle size and surface area. It is expected that the procedure and the manual will be revised as a result of continued testing and use and review by the scientific community. (Brambley-SRC)
W81-03336

INVESTIGATION OF THE LIPARI LANDFILL USING GEOPHYSICAL TECHNIQUES,
Woodward-Clyde Consultants, Plymouth Meeting, PA.
For primary bibliographic entry see Field 5B.
W81-03360

APPLICATION OF REMOTE SENSING TECHNIQUES TO EVALUATE SUBSURFACE CONTAMINATION AND BURIED DRUMS,
MITRE Corp., Bedford, MA.
H. J. Yaffe, N. L. Cichowicz, and R. W. Pease, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 352-365. 9 Fig, 3 Tab, 3 Ref.

Descriptors: *Subsurface mapping, *Groundwater pollution, *Groundwater movement, *Remote sensing, *Waste dumps, Pollutants, Plumes, Radar, Seismic properties, Conductivity, Monitoring, Cost-benefit analysis, Soil contamination.

Several remote sensing techniques (ground-penetrating radar, electrical resistivity, metal detection, and seismic refraction) were employed to investigate subsurface chemical contamination and buried drums at an uncontrolled hazardous waste site in Rhode Island. The techniques were applied in conjunction with direct sample collection to support the selection of a long-term abatement alternative for the site. Lateral and vertical resistivity surveys were used to locate contaminant plumes, which were confirmed by monitoring wells. Seismic refraction was used to locate the bedrock surface, and to estimate the depth of trenches containing drums. No method was effective in determining the depth of the trenches, but metal detection and ground-penetrating radar gave indications of trench dimensions, and drum arrangement. A comparison of remote sensing techniques is presented, and it is suggested that a combination of these techniques can be a cost-effective screening system for subsurface investigations. (Brambley-SRC)
W81-03363

ANALYSIS OF SUPERSATURATED AIR IN NATURAL WATERS AND RESERVOIRS,
Virginia Mason Research Center, Seattle, WA. Dept. of Hyperbaric Physiology.
B. G. D'Aoust, and M. J. R. Clark.
Transactions of the American Fisheries Society, Vol 109, No 6, p 708-724, November, 1980. 10 Fig, 5 Tab, 31 Ref.

Descriptors: *Supersaturation, *Measuring instruments, *Gas chromatography, Natural waters, Fish hatcheries, Water pollution effects, Columbia River, Snake River.

The physics of supersaturation are outlined, and alternatives for water sampling and analysis are discussed. Analytical techniques tested during 1976-78 in the Columbia and Snake River systems are compared. The most accurate work is done with extraction and gas chromatography, while the most efficient and inexpensive method is P(t) (total dissolved gas pressure) measurement in combination with continuous monitoring. Gas chromatographic analysis is capable of analyzing more different gases. Theory and empirical data show that laboratory analysis can slightly overestimate P(t) because of bubble formation, but continuous monitoring with P(t) can easily keep pace with fluctuating levels of supersaturation in natural waters and in large pumped water supplies. This method can be used to determine the causes of certain spatial and temporal patterns of P(t). Error in P(t) measurements due to bubbles forming on the exchange membranes is negligible, providing that either minimal agitation of the probe is maintained or it is placed at a depth greater than equilibrium depth, Z(E). (Small-FRC)
W81-03388

EFFECT OF OCEAN DUMPING ON C13/C12 RATIOS IN MARINE SEDIMENTS FROM THE NEW YORK BIGHT,
Florida State Univ., Tallahassee. Dept. of Oceanography.
W. C. Burnett, and O. A. Schaeffer.
Estuarine and Coastal Marine Science, Vol 11, No 6, p 605-611, December, 1980. 2 Fig, 1 Tab, 14 Ref.

Descriptors: *Waste disposal, *Carbon radioisotopes, *Radioisotopes, *Sewage sludge, Ultimate disposal, Sludge disposal, Pollutant identification, Sewage disposal, Water pollution effects, Continental shelf, Oceans, Sediments, *New York Bight, Path of pollutants.

The ratio of carbon isotopes C13/C12 was tested as a quantitative tracer of sewage sludge components dumped into the ocean. Studies were done on 18 surficial sediment grab samples collected in the New York Bight, the site of sewage sludge dumping since 1924. Results showed that sewage is depleted in C13 as compared with average marine sediments. In addition, C13 became more depleted in sites closer to the dump area. An equation for estimating the % sewage sludge in a sample of sediment was based on the C13 contents of organic carbon in the sample, in the normal continental shelf marine sediments (-2.2%) and in the sewage sludge (-2.6%). Effects of normal terrestrial organic carbon were considered too small to interfere. (Cassar-FRC)
W81-03390

A REMOTE SAMPLING DEVICE FOR UNDER-ICE WATER, BOTTOM BIOTA, AND SEDIMENTS,
Department of Science, Melbourne (Australia). Antarctic Div.
E. W. King, and D. A. Everitt.
Limnology and Oceanography, Vol 25, No 5, p 935-938, September, 1980. 4 Fig, 4 Ref.

Descriptors: *Sampling, *Bottom sampling, *Water sampling, Sediments, *Ice cover, Instrumentation, Antarctica, Marine biology, Aquatic life.

Water and sediment samples up to 1 liter may be collected under ice by a remote sampler using mechanical suction produced by a piston triggered with a mousetrap latch. This device is small enough to be deployed through a hole in the ice 11 cm in diameter. The hole may be easily drilled using a Sipre ice auger, which penetrates 2 meters of ice in 15-20 minutes. In field trials off Antarctica, the sampler was more consistent when compared with a Peterson grab or a gravity corer. The instrument, which is designed for Antarctic temperature conditions, performed successfully at air temperatures of +4 to -34C, a water temperature of -2C, and at all depths of water. (Cassar-FRC)
W81-03398

ENHANCED DETECTION OF BACTERIA IN NATURAL ENVIRONMENTS BY FLUOROCHROME STAINING OF DNA,
Brown Univ., Providence, RI. Div. of Biology and Medicine.
A. W. Coleman.
Limnology and Oceanography, Vol 25, No 5, p 948-951, September, 1980. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Aquatic microorganisms, *Microscopy, *Fluorescent dye, *Pollutant identification, Diamidinophenylindole, *Bacteria, Dyes, DNA, Microorganisms, Analytical techniques.

The presence of small numbers of bacteria in a natural environment is readily detected using 4',6-diamidino-2-phenylindole (DAPI), a DNA stain, in conjunction with mithramycin. Bacterial cells, living or dead, gram-negative and gram-positive, were penetrated by the staining mixture within 5 to

30 min. An epi-illumination system for fluorescence microscopy makes it possible to scan samples collected from marine or freshwater environments even when thickness of the material renders other methods unsuitable. This method is useful for detecting bacterial contaminants in allegedly axenic cultures. (Cassar-FRC)
W81-03399

STABLE LEAD ISOTOPE AS A TRACER IN COASTAL WATERS,
Institute of Ocean Sciences, Sidney (British Columbia). Ocean Chemistry Div.
For primary bibliographic entry see Field 5B.
W81-03412

THE USE OF DAPI FOR IDENTIFYING AND COUNTING AQUATIC MICROFLORA,
Georgia Univ., Athens. Dept. of Zoology.
K. S. Porter, and Y. S. Feig.
Limnology and Oceanography, Vol 25, No 5, p 943-948, September, 1980. 2 Fig, 4 Tab, 12 Ref.

Descriptors: *Aquatic microorganisms, *Microscopy, *Diamidinphenylindole, Pollutant identification, Fluorescent dye, Phytoplankton, Algae, Bacteria, Aquatic plants, Cyanophyta, Aquatic algae, Analytical techniques, Acridine orange, Dyes, DNA, Microflora.

Use of 4', 6-diamidino-2-phenylindole (DAPI), a highly specific and sensitive fluorescing stain for DNA, was compared with acridine orange (AO) for counting aquatic microflora--bacteria, cyanobacteria, and algae. DAPI proved especially useful for counting cells in eutrophic and seston-rich waters. Under these conditions the AO method masked bacterial cells. The minimum period needed to develop effective visualization for DAPI was 5 min, and the fluorescence remained stable for another 3 min. AO staining developed after 2 min and lasted for 1 min. DAPI-stained slides remained consistent for 24 weeks at 4C, allowing storage and later counting, whereas AO slides deteriorated after one week. (Cassar-FRC)
W81-03417

AN EXAMINATION OF CD, CU, AND HG CONCENTRATIONS IN LIVERS OF NORTHERN PIKE, ESOX LUCIUS, AND WHITE SUCKER, CATOSTOMUS COMMERSONI, FROM FIVE LAKES NEAR A BASE METAL SMELTER AT FLIN FLON, MANITOBA,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5C.
W81-03422

A SIMPLE AND INEXPENSIVE ARTIFICIAL-SUBSTRATE UNIT FOR OBTAINING PERIPHYTON COLLECTIONS FROM STREAMS,
Latrobe Valley Water and Sewerage Board, Traralgon (Australia).
B. C. Chessman, and S. D. McCallum.
Water Research, Vol 15, No 3, p 351-352, March, 1981. 1 Fig, 12 Ref.

Descriptors: *Biological samples, *Streams, *Rivers, Measuring instruments, Aquatic life, Bioassay, Sampling, Water sampling, Biological samples.

A floating artificial-substrate device was designed for use in all types of streams, including those with rapid currents and fluctuating water levels, to obtain periphyton collections from the water bodies. It is inexpensive, simple to construct, and made from easily-obtainable materials. It consists of a high-density polystyrene float and a trailing plastic strip from which colonizing periphyton is sampled. When the unit is installed in a moderate or rapid current, the leading edge of the float points slightly downward, presenting a small, streamlined face to the current. (Baker-FRC)
W81-03442

DETERMINATION OF POLAR VOLATILES IN WATER BY VOLATILE ORGANICS ANALYSIS,
Dow Chemical Co., Midland, MI. Analytical Labs.
T. Ramstad, and T. J. Nestrick.
Water Research, Vol 15, No 3, p 375-381, March, 1981. 7 Fig, 1 Tab, 7 Ref.

Descriptors: *Volatility, *Organic compounds, *Measuring instruments, Water analysis, Chemical analysis, Temperature, Chemical reactions.

The recovery of various volatile polar materials from water is reported, including lower alcohols, nitroparaffins, and chloro- and nitrophenols. Purge vessels smaller than the commonly used Bellar and Lichtenberg device were used in the study. For a number of the compounds purgeability was determined as a function of temperature. A sample chromatogram is presented. It is noted that enhanced purgeability and sensitivity are a benefit of elevated temperature purging, but it is also stated that undesirable chemical reactions may occur upon heating samples, including the formation of halomethanes with free chlorine. With temperature control of the purge, fractional purging may be realized, perhaps in conjunction with separate trap packings for each fraction. (Baker-FRC)
W81-03443

SIMULTANEOUS DETERMINATION OF CHLORIDE AND SULPHATE IN NATURAL WATERS BY FLOW-INJECTION ANALYSIS,
Pretoria Univ. (South Africa). Dept. of Chemistry.
W. D. Basson, and J. F. van Staden.
Water Research, Vol 15, No 3, p 333-335, March, 1981. 3 Fig, 2 Tab, 4 Ref.

Descriptors: *Chlorides, *Sulfates, *Measuring instruments, Colorimetry, *Water analysis, Chemical analysis.

The purpose of this paper is to describe the adaptation of the flow-injection concept to the simultaneous determination of chloride and sulfate in natural wastes by sample splitting. The flow injection system described is suitable for carrying out simultaneous analysis of chloride and sulfate at a rate of about 200 samples/hr, which should be particularly attractive for water labs with a high sample output. The coefficient of variation for chloride was less than 1.3% and for sulfate better than 2.0% on 15 tests for each sample. (Baker-FRC)
W81-03445

A FIELD METHOD FOR DETERMINING THE CHEMICAL AND BIOLOGICAL ACTIVITY OF SEDIMENTS,
National Water Research Inst., Burlington (Ontario). Environmental Contaminants Div.
D. Liu, and W. M. J. Strachan.
Water Research, Vol 15, No 3, p 353-359, March, 1981. 3 Fig, 6 Tab, 22 Ref.

Descriptors: *Sediments, *Chemical analysis, *Biological properties, Measuring instruments, Bioassay, Aquatic life, Sedimentation, Bottom sediments, Lake sediments, *Lake Ontario, *Lake Superior, Great Lakes.

The rapid estimation of chemical and biological activities was carried out on sediment samples from nearshore areas of two of the Great Lakes, Ontario and Superior. The method used was a spectrophotometric test based on the quantitative reduction of the dye resazurin by chemically reducing substances and by dehydrogenase in microorganisms. The chemical and biological activities are differentiated by using m-cresol to inhibit the dehydrogenase. Activity is expressed as micromol resazurin reduced/h/g sediment, dry weight. Membrane filtration and oven drying are used to determine the dry weights of the sediment samples. Sediments taken near Hamilton Harbor where there is much heavy industry showed both low biological and low chemical activity. High chemical and biological activities were recorded in the Bay of Quinte, which is eutrophic. Thunder Bay samples demonstrated high chemical and biological activities near an area receiving industrial wastes, but had only moderate to low activities in an unpolluted area. Low to moderate chemical and biological activities were recorded in the oligotrophic area of Batchawana Bay. The method described is simple to employ, sensitive, and gives good reproducibility. (Baker-FRC)
W81-03447

ELEMENTAL ANALYSIS OF SOLUBLE AND INSOLUBLE FRACTIONS OF RAIN AND SURFACE WATERS BY PARTICLE-INDUCED X-RAY EMISSION,
Florida State Univ., Tallahassee. Dept. of Oceanography.
S. Tanaka, M. Darzi, and J. W. Winchester.
Environmental Science and Technology, Vol 15, No 3, p 354-357, March, 1981. 2 Fig, 5 Tab, 12 Ref.

Descriptors: *Rain water, *Surface waters, *X-ray spectroscopy, *Trace elements, Pollutant identification, Analytical techniques, Surface runoff, Lakes, Metals.

Particle induced X-ray emission was used to analyze soluble and insoluble fractions of natural waters. Nuclepore filtration separated the two components in the sample. The filtrate was evaporated on a thin Mylar film and both fractions bombarded with a 5-MeV proton beam from a Van de Graaff accelerator. Detection limits were several nanograms. Rain water from Tallahassee, Florida, contained Al, Si, Ti, and Cr in the insoluble fraction. Fe and Pb were distributed between the two fractions. Surface waters from a lake and rainfall runoff showed similar partition of the elements between the two fractions. (Cassar-FRC)
W81-03453

THE CARCINOGENIC LOAD OF THE ENVIRONMENT: BENZO(A)PYRENE IN SEDIMENTS OF ARCTIC WATERS,
British Columbia Cancer Research Centre, Vancouver.
H. F. Stich, and B. P. Dunn.
Arctic, Vol 33, No 4, p 807-814, December, 1980. 2 Fig, 4 Tab, 20 Ref.

Descriptors: *Carcinogens, *Arctic, *Marine sediments, Aliphatic hydrocarbons, Hydrocarbons, Sediment concentration, Sediments, Baseline studies, Alaska, Canada, Benzo(a)pyrene.

The occurrence of benzo(a)pyrene, which is a carcinogenic polycyclic aromatic hydrocarbon, was measured in the shore sediments of what are generally considered to be pristine arctic waters in Alaska and Canada to provide baseline data which may be useful for detecting man-made contamination of these waters. Bottom sediments were collected from the Kotzebue and Nome area of Alaska and from the Mackenzie delta and Devon Island in Canada. The benzo(a)pyrene levels were highest in the samples taken from the Mackenzie River delta and adjacent areas of the Beaufort Sea. The benzo(a)pyrene contents of sediments close to cities were not significantly higher than those from neighboring areas. Beaches with motorboat traffic and other human activity had levels of the carcinogen which were comparable to or lower than those of areas devoid of human activity. Although there was considerable variability among samples from the same sampling area, the range of concentration in the most contaminated sites and the least contaminated sites did not overlap. It is concluded that while single samples may be useful in a preliminary assessment of the contamination of an area, multiple samples are necessary for accurate assessment of the level of contamination. A significant positive correlation was found between levels of organic material in sediments and levels of benzo(a)pyrene. The most likely natural source for the benzo(a)pyrene concentrations in areas where man-made sources appear unlikely is forest or tundra fires. (Carroll-FRC)
W81-03462

RESULTS OF A PRIMARY PRODUCTIVITY STUDY AS AFFECTED BY THE TYPE OF GLASS IN THE CULTURE BOTTLES,
Oregon State Univ., Corvallis. Dept. of General Science.
R. C. Worrest, D. L. Brooker, and H. Van Dyke.
Limnology and Oceanography, Vol 25, No 2, p 360-364, March, 1980. 3 Fig, 1 Tab, 14 Ref.

Descriptors: *Primary productivity, *Algae, *Ultraviolet radiation, Solar radiation, Cultures, Productivity, Glass, Aquatic algae, Phytoplankton, Radiation, Wave lengths, Light, Laboratory tests.

Three types of bottles used in primary productivity studies were compared. Transmittance in the ultraviolet region varied significantly: quartz, over 90% from 280 to 350 nm; Pyrex No. 7740, 0 to 90% from 280 to 350 nm; and Wheaton 800, 0 to 80% from 290 to 350 nm. Measurements of radiocarbon uptake by Thalassiosira pseudonana in the three bottle types under white fluorescent lamps (380-700 nm) were similar, about 5.1 mg C per 10 billion cells per hour. However, when a sunlamp/filter system (290-320 nm) was added, production (in mg C per 10 billion cells per hour) was less: quartz, 3.56, Pyrex, 4.15; and Wheaton 800, 4.98. The environmentally significant ultraviolet portion of the solar spectrum should be considered when culture bottles are selected for in situ primary productivity studies. (Cassar-FRC)
W81-03470

EVIDENCE FOR ALGAL HETEROTROPHY IN LAKE TAHOE, CALIFORNIA-NEVADA,
California Univ., Davis.
W. F. Vincent, and C. R. Goldman.
Limnology and Oceanography, Vol 25, No 1, p 89-99, January, 1980. 4 Fig, 5 Tab, 31 Ref.

Descriptors: *Algae, *Trophic level, Lake Tahoe, Phytoplankton, Lakes, Limnology, Laboratory studies, Photosynthesis, Monuron.

Light and dark incubations were made of water taken from Lake Tahoe. Significant differences in the uptake of carbon-14 labeled organic compounds were noted between these two incubations. Below the maximum depth of inorganic carbon photoassimilation, the response to light did not occur in situ. A photosynthetic inhibitor completely inhibited the response to light. A eucaryotic inhibitor significantly inhibited dark acetate uptake in the deep euphotic zone. Two species of green algae were able to transport acetate at labeled substrate additions within previously determined ambient limits. These two species grew heterotrophically on acetate in axenic culture. In the region of the water column where acetate uptake was light stimulated, the activities of key enzymes of the major inducible pathways for acetate assimilation were high per unit ATP. It is suggested that these data support the theory of heterotrophically active phytoplankton populations at the bottom of the euphotic zone. (Baker-FRC)
W81-03475

MARINE AND ESTUARINE POLLUTION,
California State Univ., Long Beach.
For primary bibliographic entry see Field 5C.
W81-03488

BIOASSAYS--PROCEDURES AND RESULTS,
North Carolina Univ. at Chapel Hill.
A. F. Maciorowski, L. W. Little, and J. L. Sims.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1630-1656, June, 1980. 325 Ref.

Descriptors: *Bioassay, *Water analysis, *Bioindicators, Toxicity, Water pollution effects, Analytical techniques, *Pollutant identification, Water quality, Invertebrates, Fish, Algae, Heavy metals, Industrial wastes, Microorganisms, Organic compounds, Pesticides, Oil pollution, Literature review.

Interest in aquatic bioassays to evaluate toxicant-related water pollution problems is extensive, according to the 1979 literature on this subject. Several reports from EPA and others provide compendiums or handbooks of bioassay methods, concerning test methods, quality control, and bioindicators. Although a battery of screening tests is still a common evaluation method, efforts to reduce the volume of work are suggested by many authors, who concentrate on experimental design, interaction, and strategy. New bioassay methods are described for microorganisms, algae and larger plants, invertebrates, fish, microcosms, and natural environments. Several new methods are available for testing health effects such as mutagenesis, cellular toxicity, and carcinogenesis. (Cassar-FRC)
W81-03490

THE LOSS OF CADMIUM AND ZINC FROM SEA WATER DURING ACCUMULATION EXPERIMENTS: ITS IMPLICATION ON TOXICITY THRESHOLD CONCENTRATIONS,
National Research Inst. for Oceanology, Stellenbosch (South Africa).
H. F.-K. O. Hennig, and P. J. Greenwood.
Marine Pollution Bulletin, Vol 12, No 2, p 47-50, February, 1981. 3 Fig, 1 Tab, 34 Ref.

Descriptors: *Adsorption, *Cadmium, *Laboratory equipment, Sea water, Contamination, Experimental design, Zinc, Toxicity.

A study to quantify the loss of cadmium and zinc from solutions contained in glass and polystyrene containers is described. In the case of cadmium and polystyrene containers, adsorption occurred rapidly, and equilibrium was to a large extent established before the first measurement was made at 2 min. In the glass flask experiment, 37% of the metal was adsorbed to the walls at a concentration of 0.2 micrograms/milliliter. At a higher cadmium concentration of 3 micrograms/milliliter only 18% was adsorbed. There was only negligible adsorption of zinc on polystyrene and glass bottles. Thus, in the case of cadmium, the threshold toxicity concentration for marine animals could be 30 to 40% lower than previously reported. In order to compensate for possible metal binding to experimental vessel walls, apparatus must be precontaminated for a tested period. The ideal situation is an automatically monitored open system where a constant amount of pollutant is injected into constantly replaced water. (Small-FRC)
W81-03500

BIOMONITORING OF TOXIC EFFLUENTS--A CONSULTANT'S VIEW,
Burgess and Niple Ltd., Columbus, OH.
G. B. Jones.
Industrial Water Engineering, Vol 17, No 2, p 23-27, March/April, 1980. 4 Fig, 10 Ref.

Descriptors: *Aquatic populations, *Bioassay, *Water pollution effects, Effluents, Water pollution, Sublethal effects, Water quality standards, Ecosystems, Effluent limitations, Monitoring, Stream biota, Toxicity.

The establishment of pollutant and parameter limits in the National Pollutant Discharge Elimination System (NPDES) permits and water quality standards generally is based on test results of a few controlled laboratory bioassays for one or a few aquatic species at specific life stages. These test data cannot be practically used as a basis for establishing limitations for the protection of aquatic life in natural systems. The significance of biological assessments in water quality studies is gaining recognition. Biotic community surveys are being increasingly utilized, and considerable research effort has been devoted to the development of indices and models to objectively assess the quality of aquatic systems utilizing both qualitative and quantitative species data. The design of a biological study used for a given project will depend on the scope of the study and the relative importance of water quality considerations. Even a brief field reconnaissance trip by one or two biologists to visually inspect a site and collect some qualitative data on floral and faunal community composition provides valuable information not obtained through water chemistry studies. An analysis of biotic community structure enables interpretations on the magnitude of pollution, the frequency of pollutant loading, and the general character of the polluting substance. Biological surveys are also generally less expensive than water chemistry studies. The concern for toxic pollutants expressed in recent Federal legislation has placed new emphasis on the bioassay test as a monitoring tool. The procedure proposed by the Environmental Protection Agency (EPA) for limiting toxic and hazardous pollutants is the 'application-based limit', which is judged to be ineffective in controlling these pollutants due to the absence of an assessment of the biological impact of the toxic discharge or of the assimilative capacity of the receiving stream. A draft biomonitoring protocol released by EPA in 1979 incorporates both static laboratory and dynamic on-site bioassays to screen and assess the toxicity of effluents both for setting effluent limitations and for monitoring. (Carroll-FRC)
W81-03503

TECHNETIUM-99 CONTENT IN SOME MARINE ORGANISMS COLLECTED NEAR LA HAGUE, FRANCE,
CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses (France). Dept. de Protection.
L. Jeanmaire, M. Masson, F. Patti, P. Germain, and L. Cappellini.
Marine Pollution Bulletin, Vol 12, No 1, p 29-32, January, 1981. 4 Fig, 6 Ref.

Descriptors: *Technetium, *Algae, *Bioindicators, *Nuclear wastes, Radioisotopes, Worms, Invertebrates, Cesium, Rubidium, Cerium, Radioactive wastes, Water pollution sources, Marine plants, Marine algae, Phaeophyta, Chlorophyta, Rhodophyta, Fish, Aquatic life, Mollusks, Pollutant identification, Water pollution effects, Absorption, La Hague, *France.

Brown algae in the vicinity of an effluent pipeline from the nuclear fuel reprocessing plant at La Hague, France, contained up to 3500 pCi per kg net weight of technetium-99. Red algae, green algae, worms, mollusks, tunicates, and fish samples contained less than 80 pCi per kg with the exception of 1 limpet which had 1000 pCi per kg. Ce144 was accumulated more readily by the plants and animals not concentrating Tc99. Ru106 also showed an inverse relationship, but it was not as pronounced as with Ce144. For Cs137, differences with Tc99 were even less. Brown algae, especially Fucus sp., appeared to be useful bioindicators for Tc99. Limpets should be investigated further. (Cassar-FRC)
W81-03524

HEAVY METALS, ORGANOCHLORINE PESTICIDES AND PCB'S IN GREEN MUSSELS, MULLETS, AND SEDIMENTS OF RIVER MOUTHS IN THAILAND,
Chulalongkorn Univ., Bangkok (Thailand). Dept. of Marine Science.
P. Menasveta, and V. Cheevaparanapiwat.
Marine Pollution Bulletin, Vol 12, No 1, p 19-25, January, 1981. 4 Fig, 2 Tab, 17 Ref.

Descriptors: *Pesticides, *Heavy metals, *Rivers, *Thailand, Mussels, Mullets, Metals, Copper, Lead, Zinc, Mercury, Cadmium, Polychlorinated biphenyls, Sediments, Bottom sediments, Aquatic animals, Fish, DDT, DDE, TDE, Insecticides, Heptachlor, Aldrin, Lindane, Chlorinated hydrocarbon pesticides, Organic compounds, Pollutant identification, Water pollution effects, Bioindicators.

Levels of pollutants were determined in green mussels, mullets, and sediments of 4 river mouths and a control intertidal zone in the Upper Gulf of Thailand. In green mussels, concentrations of lead ranged from 83.3 to 330 micrograms per g, mean 214, about 15 times higher than the background level. Zn, Cu, and Cd concentrations were (in micrograms per g) 47.6-91.7, 3.75-16.9, and 2.77-8.21 respectively, not greatly different from the controls. Hg level was 0.21 micrograms per g, 4 times the control level. Mullets contained (in micrograms per g) Pb 20.8-45.0, Zn 18.2-50.0, Cu 1.57-8.18, Cd 0.14-1.03, and Hg 0.01-0.25. Bottom sediments contained higher than background levels of lead, 20.2-283 micrograms per g. Hg contamination was found in one river mouth (2.8 micrograms per g). Zn, Cu, and Cd varied among river mouths but did not differ greatly from background levels. Some samples of mussels and mullet contained very low levels of lindane, heptachlor, and aldrin and slightly higher levels of DDT and metabolites, 0.032-0.042 micrograms per g for mussels and 0.022-0.089 for mullet. Polychlorinated biphenyls

were present at 0.002-0.043 micrograms per g in mussels and 0.002-0.019 in mullets. One mussel sample contained 0.11 micrograms per g PCB. Sediments contained trace amounts or nondetectable amounts of heptachlor, aldrin, BHC, lindane, and PCB. DDT and its metabolites were present at 0.022-0.056 micrograms per g, TDE being higher than DDE, the converse of the biological samples. (Cassar-FRC)
W81-03526

IDENTIFICATION OF GAMMA-CHLORDENE IN FRESHWATER FISH FROM THE TAMA RIVER (JAPAN),
Tokyo Metropolitan Research Lab. of Public Health (Japan).
S. Horii, T. Miyazaki, S. Kaneko, K. Akiyama, and T. Yamagishi.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 1, p 254-257, 1981. 2 Fig, 8 Ref.

Descriptors: *Pollutant identification, *Chlorinated hydrocarbons, *Japan, Tama River, Rivers, Monitoring, Fish, Pesticides, Separation techniques, Gas chromatography, Mass spectrometry.

Gamma-chlordene, a major constituent of technical chlordane, has been identified in freshwater fish from the Tama River of Japan. Whole body samples were homogenized with sodium sulfate and extracted with n-hexane. After evaporation and extraction into acetonitrile, followed by further washing with hexane, the sample was concentrated to 5 milliliters and subjected to cleanup on a Florisil column. The concentrate was analyzed by GC-MS with electron capture detection. Mass fragmentation patterns confirmed the presence of gamma-chlordene, which has not previously been identified in environmental biota. Gamma-chlordene was present in the sample on a wet basis at levels of 23 ppb. Other organochlorine pesticides and PCBs were present in larger amounts. (Geiger-FRC)
W81-03565

ANALYSIS AND INCIDENCE OF ORGANOPHOSPHORUS COMPOUNDS IN SEWAGE SLUDGES,
Imperial Coll. of Science and Technology, London (England).
A. E. McIntyre, R. Perry, and J. N. Lester.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 1, p 116-123, 1981. 1 Fig, 4 Tab, 11 Ref.

Descriptors: *Gas chromatography, *Organophosphorus pesticides, *Sludge, Wastewater analysis, Waste identification, Insecticides, Parathion, Malathion, Diazinon, Wastewater, Separation techniques.

An evaluation was made of analytical procedures for the determination of organophosphorus insecticides in waste waters and sewage sludges. Gas chromatographic analyses of standard solutions of diazinon, malathion and parathion, each carried through two cleanup procedures, yielded recoveries ranging from 89.5 to 102.0%. Recoveries of organophosphorus compounds from sludges were higher using the Ultra-Turrax homogenizer than with the separatory funnel. Adequate recoveries were also obtainable on smaller volumes of sample using the laboratory disperser cleanup method. Sewage sludge samples were also collected from twelve United Kingdom sewage treatment works to survey the extent of contamination by organophosphorus compounds. Results using the disperser method showed no detectable levels in 9 of the 12 sludges tested. Three of the samples contained prominent peaks, which were tentatively identified as breakdown products of parent organophosphorus compounds used as flame retardants. (Geiger-FRC)
W81-03566

DETERMINATION OF VANADIUM IN A MARINE MOLLUSC USING A CHELATING ION EXCHANGE RESIN AND NEUTRON ACTIVATION,
Oregon State Univ., Corvallis. Dept. of General Science.
Y. D. LaTouche, C. W. Bennett, and M. C. Mix.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 2, p 224-227, 1981. 1 Tab, 8 Ref.

Descriptors: *Vanadium, *Measuring instruments, *Biological samples, Heavy metals, Neutron activation analysis, Ion exchange, Resins, Chelating agents, Mollusks, Aquatic animals, Estuarine environment.

This study was designed to develop a precise method for measuring vanadium in the soft tissue of marine molluscs. A chelating resin was used to retain vanadium and eliminate sodium from a digest of the soft tissues of M. edulis. Vanadium concentrations were then obtained via neutron activation analysis of the resin loaded with the vanadium. The preirradiation elimination of sodium and the retention of vanadium in a resin matrix permitted activation at full reactor power. Irradiation time was no longer critical and may be as long as is convenient, with an accompanying reduction of timing errors. The use of full reactor power can represent an economic advantage, as expensive facilities need not be allocated to strictly low-power operations. (Baker-FRC)
W81-03571

5B. Sources Of Pollution

MODELING HEAVY METAL TRANSPORT IN RIVER SYSTEMS,
Woodard and Curran, Gorham, ME.
F. E. Woodard, J. H. Fitch, Jr., and R. A. Fontaine.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209108, Price codes: A05 in paper copy, A01 in microfiche. Land and Water Resources Center, University of Maine, Orono, Completion Report, April, 1981. 84 p, 2 Fig, 7 Tab, 170 Ref, 5 Append. OWRT-A-037-ME(1).

Descriptors: *Mathematical models, *Model studies, *Water transport, *Fate of pollutants, *Heavy metals, Particulate matter, Adsorption, Computer models, Wastewater disposal, Water pollution, Stream pollution, Water pollution effects, Water pollution sources, Water quality, Path of pollutants, Iron, Manganese, Particle size, Uptake, Suspended sediments, River flow.

This study resulted in a mathematical model for prediction of the probable fate of heavy metals in rivers downstream from wastewater discharges. The developed model accounts for hydraulic mixing processes of rivers, and relies heavily on the relationship between suspended particulate matter transport and heavy metals transport. While heavy metals are subject to many reactions, depending on pH, pFe, pMn, dilution, and physical characteristics of the river, an extensive literature review indicated that most metals are found adsorbed to suspended particulate matter surfaces. The developed model, hence, coupled mixing of a waste stream with river flow and suspended sediment load transport. Adsorption-desorption reactions were used as a basis for portioning metals among various particulate size ranges. The ultimate fate of the metals was determined primarily by the predicted transport/deposition of particulate matter. The sediment transport model of Einstein (1950), as modified by the U.S. Bureau of Reclamation, formed the basis for the developed heavy metal transport model. (Zielinski-IPA)
W81-03251

QUANTIFICATION OF NON-POINT SOURCE SEDIMENTATION THROUGH DENSITOMETRIC ANALYSIS OF COLOR INFRARED AERIAL PHOTOGRAPHY,
Sewall (James W.), Co., Old Town, ME.
T. J. Keating, J. D. Lowry, and R. S. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209157, Price codes: A05 in paper copy, A01 in microfiche. Land and Water Resources Center, University of Maine, Orono, Completion Report, April, 1981. 69 p, 10 Fig, 17 Tab, 26 Ref, 4 Append. OWRT-A-049-ME(2).

Descriptors: *Water pollution sources, *Sedimentation, *Infrared imagery, *Aerial photography, *Remote sensing, Photography, Suspended solids, Turbidity, Physical properties, Turbidity currents, Density, Density currents, Monitoring, Model studies, Mathematical models, Computer models, Maine, Quantitative analysis, Watersheds, Agricultural watersheds.

A method for the detection, quantification, and location of non-point pollution sources was established based upon the use of aerial color infrared photography. An airborne small-format camera system was flown simultaneous to minimal selected ground sampling. This allowed measurement of ground levels of turbidity and suspended solids over relatively large watershed areas. The study was limited to non-point pollution sources monitoring in watersheds in potato-producing agricultural areas in Aroostook County, Maine. Initial calibration of monitored rivers was used to assess film response to given pollutant types, with quantification by densitometry. Relations were formulated to estimate suspended solids concentrations from film density values. Calibrations were both site- and source-specific. The calibration model could be used for suspended solid concentration predictions. Turbidity levels of 5-35 NTU could be detected within plus/minus 4 NTU. Suspended solids ranged from 6-55 mg/liter, reliable to within plus/minus 7 mg/liter. The method was less appropriate to levels outside these ranges. (Zielinski-IPA)
W81-03252

FACTORS AFFECTING THE BIOAVAILABILITY OF POLYCHLORINATED BIPHENYLS (PCBS) IN SOILS,
North Carolina State Univ. at Raleigh. Dept. of Crop Science.
H. J. Strek.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209223, Price codes: A06 in paper copy, A01 in microfiche. Master of Science Thesis, 1980. 99 p, 16 Fig, 10 Tab, 199 Ref. OWRT-B-122-NC(5).

Descriptors: *Polychlorinated biphenyls, *Assimilative capacity, *Adsorption, *Soil organic matter, *Soil treatment, Aroclors, Bioaccumulation, Accumulation, Absorption, Plant populations, Soil analysis, Soil contamination, Adsorbents, Soil types, Chlorinated hydrocarbons, Toxins, Pollutants, Water pollution effects, Pollution load, Sand, Clays.

Bioassay was conducted with Aroclor 1254 (polychlorinated biphenyls (PCBs)) applied to untreated (1.4% organic matter (OM)) and peroxide-treated (0.2% OM) Lakeland sand at 0-200 ppm. Growth of redroot pigweed (Amaranthus retroflexus L.) appeared to decline greater in the treated soil at the highest PCB level. Soil was treated with 200 ppm PCB and received peaty OM and montmorillonite clay at rates of 0-10% total soil weight. OM was more effective than clay in reducing PCB toxicity in pigweed. Carbon-14 (C-14) labeled PCB was decreasing adsorbed, in the order of OM, clay, untreated sand, and treated sand, with OM content being a more important influence on adsorption than surface area. Treating soil containing 1000 ppm PCB with no growth reductions. Qualitative differences in PCB uptake appeared to occur between plant species. Activated carbon treatment reduced C-14 PCB uptake 89-100%. A triazine-resistant pigweed translocated more C-14 label to its foliage than redroot pigweed, in soil containing 100 ppm PCB and added C-14 PCB. (Zielinski-IPA)
W81-03264

ASSESSMENT OF WATER SUPPLY CONTAMINATION DUE TO UNDERGROUND COAL GASIFICATION,
New Mexico Univ., Albuquerque. Dept. of Chemistry.
T. M. Niemczyk, and E. A. Walters.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209215, Price codes: A06 in paper copy, A01 in microfiche. Project Completion Report, December, 1980. New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces, Report No 128. 94 p, 20 Fig, 20 Tab, 2 Append. OWRT-B-061-NMEX(1).

Descriptors: *Coal gasification, *Industrial development, *New Mexico, *Environmental effects, Water supply, Water quality, *Groundwater pollution, Gasification, Coal, Fuel, Underground powerplants, Water pollution, Environmental quality, Industrial plants, Trace metals, Heavy metals, Water analysis, Hydrogen sulfide, Geology, Anions, Trace levels, Organic compounds.

This study was undertaken to assess the potential for pollution by metal ions of groundwater as a consequence of proposed underground coal gasification, focusing on subbituminous coal of the San Juan Basin in northwestern New Mexico. No major aquifer exists in the region of the Fruitland Formation subbituminous coal seam (ca. 500 ft.), although the zone is saturated and a 0.6 sq. ft./day transmissivity was determined. The groundwater is of poor quality (Ca, pH 10, 6 mmho conductivity, 3900 ppm dissolved solids, 1700 ppm calcium carbonate, 50 ppm hardness). Major metal contaminants are Na, K, Mg, and Ca; As, Pb, Cd, Be, Cu ions are present on the ppb level; major anionic species were chloride, fluoride, sulfate, sulfide, and bicarbonate. Deep water samples effervesced when brought to the surface, having a strong hydrogen sulfide odor. Geological examinations were made for minerals (quartz, feldspar, kaolinite, montmorillonite) and strata. Baseline results for major/trace metal analysis of groundwater and minerals, anionic analyses and trace organic analyses of groundwater are presented. (Zielinski-IPA)
W81-03269

EFFECT OF SOIL MOISTURE CONTENT UPON ADSORPTION AND MOVEMENT OF PHOSPHORUS FROM LEACHATES OF DOMESTIC WASTE DISPOSAL SYSTEMS,
Maine Univ. at Orono. Land and Water Resources Center.
W. F. Brutsaert, W. E. Hedstrom, and T. G. McNeice.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209173, Price codes: A04 in paper copy, A01 in microfiche. Project Completion Report, November, 1980. 52 p, 21 Fig, 3 Tab, 54 Ref. OWRT-A-044-ME(2).

Descriptors: *Soil water, *Soil chemistry, Soil columns, *Leachates, *Adsorption, *Phosphorus, *Domestic wastes, Waste disposal, Available water, Moisture tension, Soil analysis, Soil environment, Environment, Soil science, Soil properties, Soil saturation, Soil tests, Soil solution, Leaching, Uptake, Nutrients, Cycling nutrients.

This investigation was undertaken in an attempt to establish the effects of soil moisture content upon movement and adsorption of phosphorus (P), knowing this relationship would help in optimizing the design of leachfields. Three plexiglass laboratory soil columns containing the same Adams soil were loaded with a P solution (25 mg/liter as P) at rates to maintain constant saturation levels throughout the column (1.0 (fully saturated), 0.86, and 0.64). Reducing the degree of saturation, by controlling infiltration rate in otherwise physically-similar columns, increased the soil adsorptive capacity and hence greatly reduced the extent of P penetration into the column per pore volume of influent applied. At saturation levels of 0.86 and 0.64, P adsorption increased five and seven times, respectively. The 24-hour P retention capacity of 476 micrograms P/gm soil as determined by batch study was exceeded in the partially saturated columns. These results can be used to optimize domestic leachfield design by maximizing partially saturated flow conditions and thereby substantially extending the life of these systems. The soil moisture retention curve and hydraulic conductivity vs. capillary pressure head relationships can be used with reasonable accuracy to predict the saturation level in long soil columns. (Zielinski-IPA)
W81-03270

THE OILSPILL RISK ANALYSIS MODEL OF THE U.S. GEOLOGICAL SURVEY,
Geological Survey Reston, VA. Water Resources Div.
R. A. Smith, J. R. Slack, T. Wyant, and K. J. Lanfear.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $15.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-687, 1980. 107 p, 7 Fig, 6 Tab.

Descriptors: *Oil spills, *Risks, Water pollution sources, *Computer models, Model studies, Monte Carlo method, Simulation analysis, *Probability distribution, Leases, Oil pollution, Environmental effects, Ecology, Water pollution control, Path of pollutants, Public lands, *Outer Continental Shelf.

The U.S. Geological Survey has developed an oilspill risk analysis model to aid in estimating the environmental hazards of developing oil resources in Outer Continental Shelf (OCS) lease areas. The large, computerized model analyzes the probability of spill occurrence, as well as the likely paths or trajectories of spills in relation to the locations of recreational and biological resources which may be vulnerable. The analytical methodology can easily incorporate estimates of weathering rates, slick dispersion, and possible mitigating effects of cleanup. The probability of spill occurrence is estimated from information on the anticipated level of oil production and method and route of transport. Spill movement is modeled in Monte Carlo fashion with a sample of 500 spills per season, each transported by monthly surface current vectors and wind velocities sampled from 3-hour wind transition matrices. Transition matrices are based on historic wind records grouped in 41 wind velocity classes, and are constructed seasonally for up to six wind stations. Locations and monthly vulnerabilities of up to 31 categories of environmental resources are digitized within an 800,000 square kilometer study area. Model output includes tables of conditional impact probabilities (that is, the probability of hitting a target, given that a spill has occurred), as well as probability distributions for oilspills occurring and contacting environmental resources within preselected vulnerability time horizons. (USGS)
W81-03279

WATER-RELATED IMPACTS OF IN-SITU OIL SHALE PROCESSING,
California Univ., Berkeley. Lawrence Berkeley Lab.
J. P. Fox.
Available from the National Technical Information Service, Springfield, VA 22161 as LBL-6300, Price codes: A15 in paper copy, A01 in microfiche. Lawrence Berkeley Laboratory Report LBL-6300, December, 1980. 327 p, 66 Fig, 77 Tab, 179 Ref. OWRT-C-7203(No 6220)(1), 14-34-001-6220.

Descriptors: *Oil shale, *Fuel, *Oil industry, *Industrial development, *Environmental effects, *Colorado, Effluents, Shales, Oil, Industrial plants, Planning, Industrial wastes, Oil wastes, In situ tests, Process water, Leachates, Drainage effects, Environmental quality, Water quality control, Water pollution control.

This report discusses water-related impacts of an in-situ oil shale industry in the Upper Colorado River Basin, focusing on a 50,000 barrel/day industry based on the modified in-situ process. The report covers US oil shale development history, reserves, geology, in-situ technologies, existing hydrology and water quality of the Basin, the major environmental problem of in-situ processing, groundwater disruption from leachates, large-scale dewatering, methods for groundwater disruption control, and the reuse, treatment and disposal of effluents resulting from in-situ retorting. While US oil shale resources are capable of meeting a significant share of US petroleum demands, production of oil from shale may have a serious and undesirable local environmental impact, particularly on water resources. Solid/liquid waste byproducts necessitate development of new control/treatment methods of these wastes, or modification of existing industrial methods. Institution of control methods is technically/economically feasible, but acceptable solutions to these problems are not presently available. Research/testing in the laboratory/field should resolve the major issues of retort abandonment and retort water treatment, and make oil production from shale a viable and important source of petroleum. (Zielinski-IPA)
W81-03281

ENVIRONMENTAL EFFECTS OF WESTERN COAL SURFACE MINING; PART VII - MICROBIAL EFFECT ON THE QUALITY OF LEACH WATER FROM EASTERN MONTANA COAL MINE SPOILS,
Montana State Univ., Bozeman. Dept. of Microbiology.
P. F. Kimble, and K. L. Temple.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-198245, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report, EPA-600/3-80-046, May, 1980. 89 p, 5 Fig, 29 Tab, 50 Ref. R803950.

Descriptors: *Coal mines, *Strip mines, *Mine wastes, *Leachates, *Bacteria, Overburden, Bioassay, Algae, Toxicity, Acid mine drainage, Water pollution sources, Iron bacteria, Sulfur bacteria, Lead.

Selected portions of test cores from the overburden of the West Moorhead coal deposit in southeastern Montana were examined for possible addition to leach water of toxic substances and for the presence of iron and sulfur bacteria which might contribute to leaching. Leachates were evaluated by measuring pH, lead, and the effect of the leachates on the Selenastrum algal assay. Both sulfur- and iron-oxidizing bacteria were isolated from a number of core samples. These bacteria differed nutritionally from thiobacilli and from other bacteria known to be involved in oxidizing sulfur and iron. Concentrations of lead in the leachates were comparable; they were not proportional to the lead content of the core samples. Most core samples were nearly neutral in reaction but some were highly acid. All acid leachates were toxic to Selenastrum. For reasons which were not determined, some non-acid leachates were also toxic to Selenastrum and some leachates stimulated Selenastrum growth. It is concluded that acid formation in overburden spoils would be a problem only when a potentially acid-forming stratum is so placed during spoil reclamation that it drains directly into a surface stream. It is recommended that laboratory bioassays be used adjunct to chemical analysis for identifying problem strata.
W81-03329

REDEQL.EPAK; AQUEOUS CHEMICAL EQUILIBRIUM COMPUTER PROGRAM,
Corvallis Environmental Research Lab., OR. Marine Div.
S. E. Ingle, J. A. Keniston, and D. W. Schults.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-217680, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report, EPA-600/3-80-049, May, 1980. 60 p, 18 Fig, 1 Tab, 21 Ref, 2 Append.

Descriptors: *Computer programs, *Chemical properties, *Equilibrium, Saturation, Aquatic environment, Metals, Water pollution, Thermodynamics, Mercury, Chromate.

This users guide is a companion to the previously published report 'A User's Guide for REDEQL.EPA' which explains the use of a computerized chemical equilibrium program for metals and ligands in aqueous systems. Modifications have been made so that input to the program remains basically unchanged from that in the previous users' guide. The major computational changes in the program include temperature corrections for equilibrium constants and activity coefficients, calculation of degree of saturation for selected solids, and theoretical attainment of an electrically neutral solution for a more realistic system. Use of the program, including improvements, is illustrated with input data for river water. Two cases are

shown: the first with insignificant quantities of EDTA and the second with large enough amounts of EDTA to cause complexing. A description of the Swiss, or surface complexation, adsorption model is included. Data in the thermodynamic data file have been slightly improved with updated constants. Mercury (I) and chromate have been added to the list of metals and ligands. (Moore-SRC)
W81-03330

IMPROVED TECHNIQUES FOR FLOW OF LIQUIDS THROUGH HAZARDOUS WASTE LANDFILLS,
Ohio State Univ., Columbus
E. Ali, and C. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 1-8. 5 Fig. 68-03-2963.

Descriptors: *Hazardous material, *Landfills, *Waste disposal, *Flow characteristics, *Statistical methods, Statistical analysis, Permeability, Waste characteristics, Flow control, Leachates.

The first phase of this research consists of developing statistical means for describing the geometric arrangement of wastes placed in disposal cells in a landfill, and is followed by development of the analytical procedures to determine how liquids flow through the waste. The flow analysis is performed on an image domain, which is statistically equivalent but geometrically simpler than the acutal geometrical arrangement of the waste disposal cell. The method has been applied to uniform rectangular cells with uniform earth cover thickness and the results can be used to give guidelines for the design of landfills. The equivalent permeability of the landfill may be increased by decreasing the earth cover thickness to cell width ratio, by increasing the ratio of permeabilities of cell and earth cover, or by increasing the cell width to height ratio, and reversing these actions if a decrease in permeability is required. More sophisticated cell geometrics, non-uniform cell demensions and earth cover, and three dimensional flows will be analyzed. (Brambley-SRC)
W81-03335

DEVELOPMENT OF A SOLID WASTE LEACHING PROCEDURE AND MANUAL,
Battelle Columbus Lab., OH.
For primary bibliographic entry see Field 5A.
W81-03336

AQUEOUS CHEMISTRY AND ADSORPTION OF HEXACHLOROCYCLOPENTADIENE BY EARTH MATERIALS,
Illinois State Geological Survey, Urbana.
S-F. J. Chou, B. W. Fisher, and R. A. Griffin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 29-42. 4 Fig, 6 Tab, 16 Ref. R806335-010

Descriptors: *Leaching, *Soil chemistry, *Physical properties, *Chemical reactions, *Chlorinated hydrocarbons, Hydrolysis, Solubility, Leachates, Adsorption, Soil types, Organic carbon, Statistical analysis, Industrial wastes.

The aqueous chemistry, adsorption, and mobility of hexachlorocyclopentadiene (C-56) in soil materials were studied in the laboratory. The solubility of C-56 in waters, soil extracts, and sanitary landfill leachates ranged from 1.03 to 1.25 ppm. Sodium hydroxide and sodium chloride decreased the solubility of C-56 in water; sodium hypochlorite slightly increased its solubility. C-56 underwent rapid hydrolysis at pH 2.51 and slower hydrolysis at pH 8.45 and 11.73. When exposed to sunlight, the half-life of C-56 was less than 4 min in aqueous solution and less than 1.2 min in hexane solution. At least four products of hydrolysis and photolysis were identified. Hexachlorocyclopentenone was the major product in low pH water, and the diolefins cis- and trans-pentachlorobutadiene were the major products in mineralized water or high pH water. Freundlich adsorption isotherm plots of C-56 sorption on soils and clay minerals yielded linear regression lines with coefficients of correlation of at least 0.98. C-56 was found to be readily adsorbed by the soil materials. The adsorption capacity and mobility of C-56 were highly correlated with the total organic carbon (TOC) content of nine soil materials and appear to be predictable from the TOC content of soils. Products of the degradation of C-56 appear to migrate through soils and might cause more of a problem than C-56 itself.
W81-03337

BEHAVIOR OF CD, NI, AND ZN IN SINGLE AND MIXED COMBINATIONS IN LANDFILL LEACHATES,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
W. H. Fuller, A. Amoozegar-Fard, E. Niebla, and M. Boyle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 18-28. 2 Fig, 1 Tab, 30 Ref. R 805731-01

Descriptors: Leaching, *Leachates, *Heavy metals, *Mathematical models, *Landfills, Solid waste disposal, Soil types, Model studies, Zinc, Cadmium, Nickel, Municipal wastes.

The concepts of the Lapidus and Amundson mathematical model have been used with actual data collected from soil column experiments conducted under controlled laboratory conditions to predict metal migration rates through soils. Simple mathematical equations are presented for predicting migration rates of Cd, Ni, and Zn contained singly and in combination in landfill-type leachates through soils of varied physical and chemical characteristics. Eight soils, representing 5 major soil orders were used in 10-cm soil columns which were leached with two municipal solid waste leachates whose salt contents had been altered to varying degrees. Flux was assumed from the results to be less important as a variable than other soil parameters. The migration behavior of Cd, Ni, and Zn was not significantly different whether contained singly or in combination with the leachates. This model is less complicated than many others, and does not require infinite information of attenuation mechanisms which would need many years to discover and evaluate. The model is concerned with nonconservative solutes and nonconventional leachates as well as raw, unspiked municipal solid waste leachates. (Brambley-SRC)
W81-03338

EVALUATION OF MOLECULAR MODELLING TECHNIQUES TO ESTIMATE THE MOBILITY OF ORGANIC CHEMICALS IN SOILS: II. WATER SOLUBILITY AND THE MOLECULAR FRAGMENT MOBILITY COEFFICIENT,
Environmental Protection Agency, Washington, DC.
J. Dragun, and C. S. Helling.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 58-70. 1 Fig, 4 Tab, 22 Ref.

Descriptors: *Mathematical models, *Pesticides, *Molecular structure, *Flow measurement, Percolation, Solubility, Physical properties, Organic chemicals, Prediction, Model studies, *Path of pollutants.

This is the second in a series of studies evaluating the use of various molecular modelling techniques to estimate the mobility of organic chemicals in soils. The objectives of this study were to identify molecular fragments within organic chemicals that may significantly enhance or retard mobility in soils; identify fragments that do not significantly enhance or retard mobility; quantify the fragment effects; and incorporate these effects into the estimation method that predicted mobility from the logarithm of the solubility. Soil thin-layer chromatography was used to quantify the mobility of 55 pesticides, having diverse chemical structures, in Hagerstown silty clay loam soil. Thirteen fragments were identified and divided into two groups. One group of fragments possessed an electronegative or electropositive character whose mobility enhancement or retardation effects were not created by, or were negligibly affected by, aromatic ring resonance. In the second group, ring resonance played an important role in establishing mobility effects. Two least squares multiple regression models, incorporating water solubility and quantifying the surface repulsion or attraction effect as a molecular fragment mobility coefficient, successfully predicted the retention factor. These two models were superior techniques for predicting the mobility of diverse organic chemicals compared to the estimation technique utilizing solubility as the only independent variable.
W81-03340

PREDICTION OF LEACHATE PLUME MIGRATION,
Oklahoma State Univ., Stillwater.
W. A. Pettyjohn, T. A. Prickett, D. C. Kent, and H. E. LeGrand.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal; Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 71-84. 1 Fig, 1 Tab, 9 Ref, 1 Append.

Descriptors: *Prediction, *Leachates, *Plumes, *Groundwater, *Pollutants, Geology, Soil structure, Hydrologic data, Landfills, Solid waste disposal, Computer models, Groundwater pollution, Water pollution prevention.

The purpose of this investigation is to develop a manual for predicting leachate plume migration and mixing in ground water that is typified by concepts and techniques that will prove useful to a permit writer with little or no expertise in hydrology. The general approach is the development of a series of techniques, ranging from very simple to rather complex that take into account the chemical and physical factors that control or influence chemical transport. The broad range of techniques consists of three phases - a numerical rating system, analytical-graphical solutions, and computer models. The numerical rating system functions as a screening system, and is based on point values placed on geologic and hydrologic characteristics in the vicinity of the contamination source. The characteristics used are: distance to a water supply; depth to the water table; hydraulic gradient; and permeability-sorption. The analytical-graphical solutions are more quantitative, in which flow and mass transport of ground water and pollutants, and evaluation of the landfill or disposal site, are considered, and direct measurements made. Computer models may be required when the hydrogeologic setting is complicated or the geochemistry of the pollutant transport is in question. No numerical model can solve all of the problems; all must be used with caution, and the use of the simplest available to solve the problem is recommended. (Brambley-SRC)
W81-03341

MECHANISMS AND MODELS FOR PREDICTING THE DESORPTION OF VOLATILE CHEMICALS FROM WASTEWATER,

Arkansas Univ., Fayetteville. Coll. of Engineering.
C. Springer, and L. J. Thibodeaux.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 85-90. 3 Tab, 16 Ref.

Descriptors: *Stabilization ponds, *Industrial wastewater, Evaporation, *Volatility, *Organic chemicals, Pollutants, Kinetics, Air pollution, Wastewater treatment, Mathematical models, Aerated lagoons, *Wastewater management, Model studies, Prediction.

Industrial wastewater contains a variety of volatile organic chemicals which may enter the air as pollutants when the waste is contained in aerated basins, evaporation ponds, stabilization basins or holding ponds. While the general mechanism and kinetics of desorption are known and equations for obtaining emission rates are available, the necessary transport coefficients are not. The transport coefficients are influenced by mechanical processes such as heating and aeration, and by the natural processes of wind, temperature, sunlight, and rain. Equations are presented for calculating transport coefficients under various conditions, for the gas phase and the water phase. Because of the potential for air pollution from surface impoundments suggestions for reducing emissions are given. These include: maximizing biochemical oxidation; building fences to reduce wind effects; covering water surface with a 'membrane'; enclosing the impoundment and treating the exit air; using alternative treatments. (Brambley-SRC)
W81-03342

ASSESSMENT OF HYDROCARBON EMISSIONS FROM LANDTREATMENT OF OILY SLUDGES,
Radian Corp., Austin, TX.
R. G. Wetherold, D. D. Rosebrook, and E. W. Cunningham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 213-223. 9 Fig, 3 Tab.

Descriptors: *Land disposal, *Hydrocarbons, *Oil industry, *Air pollution, Sludge disposal, Volatility, Soil moisture, Relative humidity, Wind velocity, Soil temperature, Air temperature, Laboratory equipment, Injection.

A small laboratory apparatus was developed to simulate some landfarming operations and the variables sludge type, sludge volatility, soil moisture content, wind speed, relative humidity, air temperature, soil temperature, sludge loading on soil, and sludge application technique were investigated for their effects on atmospheric emissions. Three sludges were used containing 92, 20 or 10% of oil. Emissions were greatest from the most volatile sludge, and were enhanced by increased soil moisture, reduced wind speed, increased humidity, increased air temperature and increased soil temperature. Increased sludge loading rates caused increased emissions from the 10% oil waste, but decreased them from the 92% oil waste. The highest emission rates occurred within the first 30 min after application of the sludge. Emissions were reduced to zero when the sludges were injected 6 in. below the surface of the soil, but were detected when the soil was tilled 4 and 6 days after injection. The laboratory landfarming simulation device can provide very reproducible results for sludge emission studies. (Brambley-SRC)
W81-03352

THE DEVELOPMENT OF LABORATORY AND FIELD STUDIES TO DETERMINE THE FATE OF MUTAGENIC COMPOUNDS FROM LAND APPLIED HAZARDOUS WASTE,
Texas Agricultural Experiment Station, College Station. Dept. of Soil and Crop Sciences.
K. C. Donnelly, and K. W. Brown.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 224-239. 4 Fig, 12 Tab, 53 Ref.

Descriptors: *Bioassay, *Hazardous materials, *Land disposal, *Industrial wastes, Oil industry, Bacteria, Hydrocarbons, Molecular structure, Leachates, Mutagens, Toxicity, Salmonella, Bacillus, *Path of pollutants.

In the present study, two biological systems were evaluated as part of a battery of bioassays to be used in determining the fate of mutagenic constituents from land applied hazardous waste. The Salmonella/microsome assay and Bacillus subtilis DNA repair assay were used to evaluate the genetic toxicity of a refinery and a petrochemical sludge. The two wastes were separated into acid, base, and neutral fractions by liquid-liquid extraction. All three separates exhibited mutagenic activity. The degradability of the petrochemical waste was evaluated in a laboratory study. The waste was mixed with a Norwood sandy clay and incubated in a soil respirometer for 180 days at 30C. Following the incubation period, the residual hydrocarbons were extracted from the soil for analysis by the biological systems. The mutagenic effects of the saturate and aromatic fractions appear to be reduced by soil incubation, while no such reduction was observed in the condensed ring fraction. Additional information was collected on the mutagenicity of leachate and runoff water collected from field lysimeters amended wiith the two wastes. Only a few samples of the leachate contained low levels of activity, while the mutagenic activity of the runoff decreased with time following application. These results indicate that biological analysis can be useful to evaluate the fate and mobility of the mutagenic constituents of wastes disposed of by land treatment. (Brambley-SRC)
W81-03355

INVESTIGATION OF THE LIPARI LANDFILL USING GEOPHYSICAL TECHNIQUES,
Woodward-Clyde Consultants, Plymouth Meeting, PA.
J. R. Kolmer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 298-311. 9 Fig.

Descriptors: *Landfills, *Leachates, *Electrical studies, Magnetic studies, Water pollution sources, Metals, Solid waste disposal, Liquid wastes, *Groundwater pollution, Radar, Conductivity.

As part of the EPA's remedial action research program a qualitative investigation was conducted on the LiPari landfill site in Gloucester County, New Jersey. Over a period of 12-13 years, approximately 9,200 cu m of solids and 11,000 cu m of liquids were disposed at the site, which is now a major source of ground and surface water pollution. The landfill site was surveyed using a proton magnetometer for the detection of metallic objects (chemical waste drums). Subsurface interface radar was used as a more selective locator of metal objects. The results correlated well with those from the magnetometer, and the correlations were confirmed by results from use of an M-Scope pipe and cable finder. The conductivity of the groundwater was surveyed in the area in which contamination was thought most likely. The conductivity pattern is considered to be an approximation of the plume of contaminated groundwater downgradient from the landfill site. Techniques relying on electromagnetic wave propagation can be very useful in this type of study, but are limited to locations where there are no sources of interference. (Brambley-SRC)
W81-03360

APPLICATION OF REMOTE SENSING TECHNIQUES TO EVALUATE SUBSURFACE CONTAMINATION AND BURIED DRUMS,
MITRE Corp., Bedford, MA.
For primary bibliographic entry see Field 5A.
W81-03363

SOURCES OF CHLORIDE AND SULFATE IN GROUNDWATER BENEATH AN URBANIZED AREA IN SOUTHEASTERN WISCONSIN,
Wisconsin Univ.-Madison. Dept. of Geology and Geophysics.
S. B. Gelb, and M. P. Anderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-212391, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, University of Wisconsin Technical Report WIS WRC 81-01, 1981. 35 p, 10 Fig, 6 Tab, 23 Ref, Append. OWRT-A-083-WIS(1), 14-34-0001-0153.

Descriptors: Groundwater, *Groundwater pollution, Geohydrology, Groundwater movement, Surface water, Monitoring, Observation wells, *Wastewater, Sulfates, Chlorides, Aquifers, *Path of pollutants, *Surface-groundwater relations, *Menomonee River basin, Wisconsin, Evaluation, Water pollution sources, Landfills, Leachates, Septic tanks, Road salt.

Groundwater levels and quality were monitored in the Menomonee River Watershed in southeastern Wisconsin from November 1979 to June 1980. Surface water quality was monitored at nine river locations. Results confirmed the findings of a reconnaissance investigation during 1976-77 that chloride and sulfate occur in high concentrations in groundwater in this area. However, there appeared to be a trend towards improved groundwater quality from 1976 to 1980, demonstrated by decreases in concentrations of sulfate, chloride, ammonia and bacteria. This apparent improvement is attributed partly to discontinued use of some leaky sewer lines and to higher precipitation during 1979-80. Chloride sources in groundwater include river water polluted by treated wastewater and road salt, leachate from landfills and effluent from septic tank systems. Sulfate sources include landfills and the oxidation of pyrite found in organic material. One well, which was finished close to the top of the Niagara dolomite, yielded water high in sulfate. It is possible that sulfate-rich water moves upward from the dolomite bedrock into the upper glacial aquifer in some groundwater discharge areas along the Menomonee River.
W81-03365

THE CHEMICAL AND BIOLOGICAL IMPACT OF KLAMATH MARSH ON THE WILLIAMSON RIVER, OREGON,
Portland State Univ., OR. Environmental Sciences and Resources.
E. M. Perdue, C. R. Lytle, M. S. Sweet, and J. W. Sweet.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-212417, Price codes: A10 in paper copy, A01 in microfiche. Project Completion Report, March, 1981. Water Resources Research Institute, Oregon State University, Corvallis, Report WRRI-71. 199 p, 16 Fig, 22 Tab, 44 Ref, 9 Append. OWRT-A-047-ORE(1).

Descriptors: *Water quality, *Oregon, *Chemical analysis, Water pollution sources, *Trace metal transport, Iron, *Organic matter, Amino acids, Sugars, Impaired water quality, Water pollution effects, Water pollution, Stream pollution, Pollutant identification, Bioindicators, Pollutants, Pollution load, Environmental protection, Trace levels, *Trace elements, Environmental tracers, Water analysis, Gas liquid chromatography, Algae, *Marshes, Kalmath Marsh, Williamson River.

A comprehensive chemical and biological study was made of the Williamson River before/during/

after its passage through Klamath Marsh to assess the chemical nature of organic matter, its role in trace metal transport, and the general impact of marsh environments on river water quality. In the Sprague River (major Williamson River tributary), iron is transported primarily as suspended particulate matter (less than 0.80 micrometers); in the Marsh, this matter is weathered, yielding iron-aquatic humus complexes.Hence, most iron and aquatic humus in part-marsh Williamson River are in the size fraction less than 0.025 micrometers. The marsh provides a source for amino acids, almost exclusively humic-bond, and sugars, present as polysaccharides or humic-bound. Data indicated ground waters following into the pre-marsh rivers come from a different source than those which enter the post-marsh Williamson. Cessation of humic-rich marsh water flow during summer months decreased the flux of aquatic humus, iron, amino acids, and other marsh-derived solutes in the post-marsh Williamson. Algae differences in the Williamson River system and in Upper Klamath Lake were observed. Somewhat low nitrate levels and quite high phosphate levels were also noted for the River system. (Zielinski-IPA)
W81-03366

ANALYSIS, DISTRIBUTION, AND INTERACTIONS OF CHROMIUM IN THE AQUATIC ENVIRONMENT,
Maine Univ. at Orono.
L. M. Mayer, L. L. Schick, P. M. Rossi, H. H. Patterson, and C. A. Chang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-212300, Price codes: A04 in paper copy, A01 in microfiche. Land and Water Resources Center, University of Maine Project Completion Report, April, 1981. 58 p, 22 Fig, 2 Tab, 54 Ref. OWRT-B-016-ME(4).

Descriptors: *Chromium, *Aquatic environment, *Tannery wastes, *Distribution patterns, *Maine, Water quality, Chemical analysis, Water pollution sources, Heavy metals, Trace metals, Trace elements, Cyclic storage, Distribution, Impaired water quality, Water pollution, Pollution load, Stream pollution, Path of pollutants, Fate of pollutants, Environmental tracers, Pollutant identification.

This project was designed as a response to the combination of substantial chromium (Cr) pollution in parts of Maine and general lack of knowledge about its likely environmental cycling. Study was made downstream of a Hartland tannery on the Sebasticook River, and one in Saco on the Saco River just above its opening in the Gulf of Maine. Accumulation of Cr in Saco River sediments was found to occur in patterns controlled by hydrography and grain size. Pollutant impact assessment was made possible by textural normalization using sediment specific surface areas. Oxidation of dissolved/particulate CR(III) was shown not likely in the Saco estuary; and effluent dissolved CR(III) is not likely retained, but rather flushed out to sea, bound to iron-humic colloids. Cr(III) sediment adsorption decreased with increasing salinity, and is not likely to be important, except in deposited sediments. Chemiluminescent analysisensitivity of free aqueous Cr(III) was enhanced by added halides, especially bromide, making possible the application of this technique to seawater Cr analysis. (Zielinski-IPA)
W81-03367

VIRUS TRANSPORT THROUGH PERCOLATING BEDS,
California Univ., Los Angeles. Dept. of Chemical, Nuclear, and Thermal Engineering.
V. L. Vilker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-212409, Price codes: A02 in paper copy, A01 in microfiche. California Water Resources Center, University of California, Davis Project Completion Report, April, 1981. 16 p, 6 Fig, 19 Ref, 1 Append. (California Water Resources Center Project UCAL-WRC-W-523). OWRT-B-184-CAL(10).

Descriptors: *Viruses, *Soil contamination, Wastewater pollution, Soil types, *Model studies, *Path of pollutants, *Percolation rate, Deep percolation, Seeps, Bacteriophage, Enteroviruses, Soil analysis, Soil columns, Silt, Loam, Mass transfer, Fate of pollutants, Percolation, Water analysis, Leaching, Flow, Infiltration, Pollutants, Pollutant identification, Pathogens, Wastewater.

Results of a three-year research project, directed towards modeling and experimental study which will lead to a quantitative description of virus movement in soil, are presented. Such movement has important implications for land treatment of wastewater. The developed adsorption mass transfer model describes the movement of single virus particles through packed beds of soils and soil components. The model predicts that a particular bacteriophage will breakthrough one meter of silt loam soil in sixty days for percolation rates of about 40 in./week. Experimental study on an enteric virus (attenuated poliovirus I) showed that single virus particles are likely to be present in land spread treated wastewaters; that virus association with sand is about 50-fold stronger than the phage association with silt loam soil; and that virus interaction with 1-2 micrometer montmorillonite clay particles is affected by clay aggregation at high virus titers. Future versions of the model should incorporate inactivation kinetic expressions for enteric virus inactivation in soil-water. (Zielinski-IPA)
W81-03369

EFFECT OF OCEAN DUMPING ON C13/C12 RATIOS IN MARINE SEDIMENTS FROM THE NEW YORK BIGHT,
Florida State Univ., Tallahassee. Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W81-03390

PLUTONIUM UPTAKE BY MARINE PHYTOPLANKTON IN CULTURE,
Woods Hole Oceanographic Institution, MA.
N. S. Fisher, B. L. Olson, and V. T. Bowen.
Limnology and Oceanography, Vol 25, No 5, p 823-839, September, 1980. 8 Fig, 39 Ref.

Descriptors: *Plutonium, *Phytoplankton, *Absorption, Algae, Glass, Sea water, Path of pollutants, *Marine algae, Sedimentation, Laboratory studies.

Initial rates of plutonium uptake by algal cultures of live and dead cells of Thalassiosira pseudonana, Thalassiosira sp., Platymonas sp., and glass particles were similar, indicating a passive mechanism. Uptake was affected more by the nature of particle surfaces than by the composition of the medium. Plutonium uptake was greater in rapidly growing cultures vs. senescent cultures, in acid-washed glass particles vs. unwashed glass particles, and in cells in ultraviolet-treated water vs. sea water untreated or enriched with EDTA or vitamins. After 2 hours of contact with cells, plutonium was 25% removable in tracer-free medium, but was unremoveable after 3 days' exposure. Results indicate that plutonium entering a marine system would quickly and irreversibly associate with suspended particulates, which could act as vehicles for vertical transport to the ocean depths. (Cassar-FRC)
W81-03397

ADSORPTION OF PHOSPHATE IN ANOXIC MARINE SEDIMENTS,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
M. D. Krom, and R. A. Berner.
Limnology and Oceanography, Vol 25, No 5, p 797-806, September, 1980. 4 Fig, 5 Tab, 40 Ref.

Descriptors: *Adsorption, *Phosphates, *Sediments, Path of pollutants, Bottom sediments, Iron compounds, Oxygen.

Adsorption of dissolved phosphate was studied in samples of marine sediments collected from two locations in Long Island Sound. Kinetic experiments under anoxic conditions indicated that desorption was more rapid than adsorption, both reaching equilibrium within 24 hours. The in situ adsorption coefficients obtained from the two sites were 1.7 and 1.9. These values, confirmed by diffusion measurements, were much lower than the coefficient for an oxic mud (34.4) because the iron oxyhydroxides important to phosphate adsorption in oxic sediments are converted to iron sulfides in anoxic muds. (Cassar-FRC)
W81-03400

AN INSTRUMENTAL VARIABLE METHOD OF ESTIMATING DIFFERENTIAL-EQUATION MODELS OF DISPERSION AND WATER QUALITY IN NON-TIDAL RIVERS,
Institute of Hydrology, Wallingford (England).
P. G. Whitehead.
Ecological Modelling, Vol 9, p 1-14, February, 1980. 6 Fig, 1 Tab, 18 Ref.

Descriptors: *Model studies, *Rivers, Hydrologic data, Mathematical models, Dispersion, Water quality, Nontidal currents, *Path of pollutants.

In this study an approach is used to model dispersion and water quality parameters in non-tidal rivers where the parameters of the differential-equation model are estimated directly from discrete-time data. The technique of state-variable filtering is incorporated into an instrumental variable estimation procedure, to avoid the problems entailed in measuring the derivatives of the system variables. Derivatives are determined from discrete-time data, and together with the instrumental variable estimation algorithm, provide estimates of the parameters in the differential equation model. A second-order differential-equation model of dispersion is estimated, using field data obtained from tracer experiments. The approach is also extended to a multivariable state-space model for biochemical oxygen demand and dissolved oxygen variations in a river system. (Baker-FRC)
W81-03405

AN ECONOMICAL APPROACH TO DETERMINING THE EXTENT OF GROUND-WATER CONTAMINATION AND FORMULATING A CONTAMINANT REMOVAL PLAN,
California State Dept. of Water Resources, Monterey Park.
K. W. Mido.
Ground Water, Vol 19, No 1, p 41-47, January/February, 1981. 13 Fig, 8 Ref.

Descriptors: *Groundwater movement, *Groundwater pollution, *Fluid mechanics, *Model studies, Graphical analysis, Flow system kinematics model, Path of pollutants, Mathematical models, Water pollution control, Drilling, Test wells.

The flow systems kinematics mathematical model provides a pictorial representation of groundwater movement. This model, which requires little hydrogeologic data, can aid in determining the extent of groundwater contamination and in formulating a containment or removal plan. This paper describes the development of flow path and arrival time plots, from which much information can be obtained. A hypothetical case of groundwater pollution by a toxic substance from an industrial source illustrates the model. Groundwater contamination is determined using this model, followed by a limited drilling and sampling program to confirm the results. Contaminant removal plans are rapidly evaluated, and the best alternative is chosen. (Cassar-FRC)
W81-03409

GROUND-WATER QUALITY CHANGES DURING EXPLOITATION,
Research Inst. on Environmental Development, Poznan (Poland).
T. Blaszyk, and J. Gorski.
Ground Water, Vol 19, No 1, p 28-33, January/February, 1981. 6 Fig, 2 Tab, 8 Ref.

Descriptors: *Aquifers, *Water wells, *Sulfates, Water quality, Dissolved solids, *Groundwater pollution, Potentiometric level, *Poland, Wells, Oxidation, Pumping, Hydrogeology, Water table, Bacteria, Sulfur bacteria, Path of pollutants, Water pollution sources.

Water from wells drilled into a quaternary aquifer in an ice marginal valley in western Poland decreased in quality after five months of intensive pumping. Dissolved solids and acidity increased, causing corrosion and clogging of municipal water equipment. Normally there is an upward groundwater flow in this area. However, the heavy pumping caused the potentiometric surface to fall so that oxygen entered the formation, oxidizing sulfur to sulfates, which dissolved Ca, Fe, Mn, and other materials. In addition, the more acid water from the upper part of the aquifer also entered the wells. Bacterial sampling showed the predominance of sulfur-oxidizing organisms in the environment altered by pumping and sulfur-reducing organisms in the natural environment. (Cassar-FRC)
W81-03410

STABLE LEAD ISOTOPE AS A TRACER IN COASTAL WATERS,
Institute of Ocean Sciences, Sidney (British Columbia). Ocean Chemistry Div.
V. J. Stukas, and C. S. Wong.
Science, Vol 211, No 4489, p 1424-1427, March, 1981. 2 Fig, 1 Tab, 12 Ref.

Descriptors: *Lead, *Stable isotopes, *Tracers, Mining, Gasoline, Path of pollutants, Pollutant identification, Analytical techniques, *British Columbia, Air pollution, Heavy metals, Metals, Water pollution sources, Sea water.

Lead isotope ratios, Pb-206/Pb-207, were used to identify the sources and trace the path of lead in sea water along the Coast of British Columbia. Ratios identified previously were: gasoline lead from Vancouver and Victoria, 1.16; gasoline lead from Seattle, 1.23; and lead from mining activities near Vancouver, 1.18-1.22. The sea water samples had lead isotope ratios of 1.24 for coastal oceanic water, 1.22 for waters receiving mine tailings, and 1.16 for waters near urban centers. Total lead concentrations varied from 1,200 ng per kg near the lead mine area to none detected. (Cassar-FRC)
W81-03412

VARIATION IN NUTRIENT REMOVAL FROM A STREAM BY WATERCRESS (NASTURTIUM OFFICINALE R. BR.),
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
For primary bibliographic entry see Field 5D.
W81-03420

ON THE CHELATION OF TOXIC TRACE METALS BY HUMIC ACID OF MARINE ORIGIN.
Kernforschungsanlage, Juelich (Germany, F.R.)
L. J. Musani, P. Valenta, H. W. Nurnberg, Z. Konrad, and M. Branica.
Estuarine and Coastal Marine Science, Vol 11, No 6, p 639-649, December, 1980. 7 Fig, 3 Tab, 30 Ref.

Descriptors: *Estuaries, *Humic acids, *Metals, Chelation, *Trace elements, Zinc, Lead, Cadmium, Sea water, Chemical reactions, Ions, Anions, Cations, Electrophoresis, Path of pollutants.

Humic acid in concentrations normally present in the ocean did not affect chelation of trace metals in 100% seawater. However, in less saline estuarine water, chelation may play a role, especially if higher concentrations of humic acid are present. High voltage paper electrophoresis was used to study Zn65, Cd109, and Pb210-Bi210 in seawater and 0.55 M NaCl solution with and without humic acid. With no humic acid present, Cd showed cationic behavior at all concentrations of seawater (10, 30, and 100%). Zn was largely cationic, with an immobile zone. Pb had small cationic activity in 100% seawater, increasing at 10% seawater. All 3 metals were essentially cationic in 0.55 M NaCl. Addition of humic acid to seawater solution caused some chelation with metals, strength of binding being in the order Pb>Zn>Cd. Levels of humic acid required to produce noticeable changes in chelation were in the range of 100-150 mg per liter (natural seawater contains about 0.6 mg per liter). (Cassar-FRC)
W81-03421

CONCENTRATION OF ANIONIC DETERGENTS IN RIO GRANDE WATER (SOUTH BRAZIL),
Universidade Federal do Rio de Janeiro (Brazil). Base Oceanografica Atlantica.
R. Kantin, M. G. Z. Baumgarten, M. Cabeda, A. C. Beaumord, and T. L. DeAlmeida.
Marine Pollution Bulletin, Vol 12, No 2, p 50-53, February, 1981. 2 Fig, 6 Ref.

Descriptors: *Detergents, *Estuaries, *Municipal wastewater, Phosphates, Ammonia, Sewage, Salinity, Water pollution sources, *Brazil.

The concentrations of anionic detergents, polyphosphates, ammonia, seston, and dissolved oxygen were determined in a small bay near the principal sewage discharge of the city of Rio Grande, Brazil. Surface samples were collected every half hour from 9:30 to 10:00 the following day on October 8, 1979. The salinity was low, which indicated a low degree of penetration of marine water into the estuary. The other parameters measured showed irregular fluctuations due to the variations of the sewage outlet, except for temperature and pH. Concentrations of anionic detergents ranged from 0.05 to 4.5 ppm Manoxol O.T., the highest concentrations being recorded between 09:00 and 10:00 and 17:00 and 21:00 hours. No correlation was found between detergents and polyphosphates. The average concentration of detergents was 0.73 mg/liter, polyphosphates 8.5 mg/liter, phosphates 7.0 mg/liter, and ammonia 5.5 mg/liter. The high level of phosphates and polyphosphates suggests discharges of large quantities of detergents, which could lead to dystrophic conditions. (Small-FRC)
W81-03440

HAZARDOUS WASTE LANDFILLS,
J. Josephson.
Environmental Science and Technology, Vol 15, No 3, p 250-253, March, 1981. 1 Fig, 1 Tab, 6 Ref.

Descriptors: *Landfills, *Waste disposal, *Chemical wastes, Industrial wastes, Water pollution sources, Regulations, Incineration, Leachate, Disposal, Solid wastes, *Hazardous materials.

Regulations for landfills, where 80% of hazardous waste is now disposed, will take effect in three phases. The first two, already in force, require owners of hazardous waste management facilities to register with EPA and apply for a permit. Inspection programs are being implemented. Phase III, involving more detailed technical standards, may not be implemented for five or more years. Proper design, construction, management, and closure of landfills will minimize groundwater pollution. Monitoring programs include at least four wells (1 upgradient and 3 downgradient) and regular sampling and analysis. Many doubts have been voiced about the long-term effects of 'secure' landfills on groundwater quality, raising the question of alternative technologies such as high temperature incineration. (Cassar-FRC)
W81-03450

NEW TECHNOLOGIES: HOW TO ASSESS ENVIRONMENTAL EFFECTS,
Ball State Univ., Muncie, IN.
P. J. Sullivan, and M. L. Lavin.
Environmental Science and Technology, Vol 15, No 3, p 262-267, March, 1981. 5 Fig, 1 Tab, 13 Ref.

Descriptors: *Coal mines, *Acidic water, Mining, Mine drainage, Water requirements, *Environmental effects, Industrial wastes, Water pollution sources, Boreholes, Water resources, Ecology, Water quality.

A method of assessing environmental effects is illustrated with a comparison of two coal mining methods, the room and pillar system (RP) and the newer hydraulic borehole mining system (HBM). Four steps are involved--definition of engineering characteristics, characteristics of the coal region involved (in this case, Clay County, Kentucky), assessment of each system at the conceptual design stage, and another assessment at a more advanced stage. The RP system requires water resources of 40,000 gal per day for a 24 hour operation; the HBM, 4 hours of cutting at 200 gal per min and 16 hours of pumping at 260 gal per min, with water recycled. The deep mining RP systems disturb the surface and cause erosion and sedimentation, but the HBM produces three to five times as much sediment during operations. Any of the large number of slurry lines used in the HBM could break, causing pollution. Both acid mine drainage and groundwater flow disturbance are threats from both methods. (Cassar-FRC)
W81-03451

DEVELOPMENT OF A COMPUTER-GENERATED EQUILIBRIUM MODEL FOR THE VARIATION OF IRON AND MANGANESE IN THE HYPOLIMNION OF LAKE MENDOTA,
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
For primary bibliographic entry see Field 2H.
W81-03452

THE BENTHOS OF A PORTION OF THE SACRAMENTO RIVER (SAN FRANCISCO BAY ESTUARY) DURING A DRY YEAR,
California Univ., Davis. Hydrobiology Lab.
C. A. Siegfried, M. E. Kopache, and A. W. Knight.
Estuaries, Vol 3, No 4, p 296-307, December, 1980. 5 Fig, 4 Tab, 24 Ref.

Descriptors: *Invertebrates, *Benthic fauna, *Sediment, Salinity, Droughts, Low flow, Saline water intrusion, Clams, Amphipoda, *San Francisco Bay, Sacramento River, *Benthos, San Joaquin River, California, Path of pollutants, Aquatic animals, Estuaries, Water quality, Oligochaetes, Polychaetes, Nematodes.

The fourth driest year on record coincided with a study of the benthos of a 20 km section of the Sacramento River-San Joaquin River Estuary in 1976. Water quality at 7 sites showed little vertical or horizontal variation in temperature, pH, and dissolved oxygen. Salinity increased from nearly fresh water in January to nearly 10% salinity near the end of the year at the station furthest downriver. Sediment composition changed seasonally, sands dominating early in the year and silts and clays in late summer. Sediments highest in silt contained the highest levels of grease, oil, organic carbon, and metals (Hg, Zn, Cu, Cd, Cr, and Pb). These pollutants are not considered a present hazard to the benthic community but may cause water quality problems in the future. Size and species composition of the benthos was controlled by salinity and sediment composition, upstream sites having a higher abundance. Highest populations were found in June, lowest in November. Macroinvertebrates dominating the community and comprising 98% of the total were Asiatic clam, Macoma balthica, Oligochaetes, amphipods Corophium stimpsoni and C. spinicorne, nematodes, and a polychaete, Boccardia ligerica. (Cassar-FRC)
W81-03454

LONGITUDINAL CHARACTERIZATION OF A TIDAL MARSH CREEK SEPARATING TWO HYDROGRAPHICALLY DISTINCT ESTUARIES,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
For primary bibliographic entry see Field 2L.
W81-03457

OXYGEN CONSUMING PROPERTIES OF EFFLUENTS FROM FISH FARMS,
Wildlife and Freshwater Fish Directorate (Norway).
A. Bergheim, and A. Sivertsen.
Aquaculture, Vol 22, No 1/2, p 185-187, January, 1981. 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Fish farming, *Aquaculture, *Chemical oxygen demand, Biochemical oxygen demand, Organic loading, Path of pollutants, Water pollution, Effluents, Trout.

Chemical and biochemical oxygen demands were measured in fish feeds and in inlet-outlet water at freshwater trout farms in Norway. The 5 dry feeds had COD of 1260-1340 g oxygen per kg and BOD7 of 500-800 g oxygen per kg. The one wet feed had COD, 760 g oxygen per kg and BOD, 400-450 g oxygen per kg. One kg of dry feed corresponded to 7-10 population equivalents as BOD7. The biochemical net loadings determined from measurements on inlet and outlet water during feeding were 30-50%. The oxidation course of the effluent followed that of sewage. Highest effluent loadings occurred during daily cleaning routines. (Cassar-FRC)
W81-03466

ORTHOPHOSPHATE UPTAKE BY PHYTOPLANKTON AND SEDIMENT,
Auburn Univ., Alabama. Dept. of Fisheries and Allied Aquacultures.
C. E. Boyd, and Y. Musig.
Aquaculture, Vol 22, No 1/2, p 165-173, January, 1981. 3 Fig, 5 Tab, 14 Ref.

Descriptors: *Phytoplankton, *Fish farming, *Phosphorus, Fertilizers, Sediments, Bacteria, Phosphates, Ponds, Nutrients, Chlorophyll, Path of pollutants, Aquaculture, *Orthophosphates.

The fate of orthophosphate fertilizers added to fish ponds was studied in the laboratory, in plastic pools, and in earthen ponds. Planktonic communities with chlorophyll a concentrations from 3.4 to 67.8 micrograms per liter removed between 5 and 100% of phosphate added at 0.3 mg per liter within 24 hours. Sediment water systems with varying alkalinity, hardness, organic matter, phosphorus, calcium, and soil types removed 70 to 90% of phosphate added at 0.3 mg per liter. Methods for enhancing plankton uptake of fertilizer are small, frequent applications of liquid fertilizers and placing granular fertilizer on underwater platforms. (Cassar-FRC)
W81-03467

POWER INDUSTRY WASTES,
Tennessee Valley Authority, Chattanooga.
T-Y. J. Chu, and H. Olem.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1433-1445, June, 1980. 1 Tab, 124 Ref.

Descriptors: *Industrial wastes, *Powerplants, *Electric power industry, Nuclear powerplants, Fossil fuels, Thermal pollution, Radioactive wastes, Water pollution sources, Water pollution effects, Waste treatment, Radionuclides, Nuclear wastes, Wastes, Environmental effects, *Coal, Cooling water, Regulations, Waste disposal, Fly ash, Air pollution, Literature review.

Recent environmental regulations related to the power industry are listed in tabular form in this review of recent literature on power industry wastes. Fossil fuel fired power plants have greater health and environmental impacts than nuclear power plants. Several papers concern toxic and carcinogenic materials produced from coal burning, the effects of power plant cooling water entrainment of aquatic life, and methods of siting plants. Characterization, treatment, disposal, and utilization of fly ash produced by coal burning plants are discussed. Aspects of cooling water included are environmental impact, treatment, and prevention of biofouling. Flue gas desulfurization methods and characterization, treatment, and disposal of the waste produced are the subjects of several papers. Impact of nuclear power plants on the environment requires consideration of impingement and entrainment of aquatic life in cooling waters, thermal pollution, toxicity of biocides, and radionuclides. Several methods to select plant sites are reviewed. Methods for treatment and disposal of radioactive wastes involve long-term burial, solidification, and reducing waste volume. Waste heat produced by power plants has been used in several ways--fish and shellfish culture, building and greenhouse heating, and cogeneration of heat and power. (Cassar-FRC)
W81-03479

SOLID WASTES AND WATER QUALITY,
Washington Univ., Seattle.
F. B. DeWalle, and E. S. K. Chian.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1494-1506, June, 1980. 111 Ref.

Descriptors: *Solid wastes, *Landfills, *Leachates, Water quality, Waste disposal, Wastes, Municipal wastes, Industrial wastes, Chemical wastes, Water pollution sources, Path of pollutants, Disposal, Pollutant identification, Viruses, Environmental effects, Polychlorinated biphenyls, Organic compounds, Mine wastes, Soil amendments, Ultimate disposal, Waste treatment, Radionuclides, Reviews.

A literature review of recent papers on solid waste disposal and its impact on water quality cites many case studies of groundwater and surface water pollution by chemicals, microorganisms, radionuclides, metals, and industrial wastes from landfills and land application of wastes. Design and operation of landfills and attenuation of pollutants is reported. Gas production (methane, hydrogen, and carbon dioxide) and energy recovery formed the subject of several papers. New methods of characterizing and treating wastes include leachability tests, complexation studies, determination of enteric viruses, and heavy metal removal. Solidification techniques for processing wastes are examined. (Cassar-FRC)
W81-03484

WATER POLLUTION--NONPOINT SOURCES,
Browne (F.X.) Associates, Lansdale, PA.
F. X. Browne.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1506-1510, June, 1980. 47 Ref.

Descriptors: *Water quality, *Nonpoint pollution sources, Water pollution sources, *Agricultural wastes, Agriculture, Nutrients, Waste water, Heavy metals, Runoff, Storm water, *Storm runoff, Model studies, Path of pollutants, Urban areas, Literature reviews.

Recent information on nonpoint source water pollution is summarized in a literature review. Although agricultural lands are responsible for much nonpoint source pollution, road deicers, storm water runoff from urban areas and runoff from the vicinity of industrial plants are significant. Water quality in reservoirs and lakes is affected by a variety of situations where domestic effluents or pesticide spraying have polluted groundwater and surface waters. Many nonpoint source models are applied during planning to predict pollutant movement and effects of land use. Several papers explore nonpoint source controls. (Cassar-FRC)
W81-03485

GROUND WATER,
Geraghty and Miller, Inc., Syosset, NY.
For primary bibliographic entry see Field 2F.
W81-03487

DISPOSAL FACILITY DESIGN FOR OIL-FIRED BOILER SLUDGE,
For primary bibliographic entry see Field 5E.
W81-03515

TEMPERATURE STRUCTURE AND WATER CHEMISTRY OF THE CALDERA LAKE OSKJUVATN, ICELAND,
Marine Research Inst. Reykjavik (Iceland).
For primary bibliographic entry see Field 5C.
W81-03521

PHOSPHATE ADSORPTION AND DESORPTION IN A TROPICAL ESTUARY (MARACAIBO SYSTEM),
Universidad Central de Venezuela, Caracas. Dept. of Environmental Studies.
D. Lopez-Hernandez, T. Herrera, and F. Rotondo.
Marine Environmental Research, Vol 4, p 153-163, 1980-81. 2 Fig, 3 Tab, 44 Ref.

Descriptors: *Sediments, *Estuaries, *Phosphates, Sorption, Eutrophication, Maracaibo, Phosphorus compounds, Path of pollutants, Tropical regions, Adsorption, Iron, Aluminum, Manganese, *Venezuela.

Capacity for phosphate sorption varied considerably in 17 sediment samples from the Maracaibo Estuary, a 12,000 sq km tropical system with underlying hydrocarbon deposits and increasing pollution. Several factors affected this variability. The most important controlling factor appeared to be iron content (amorphous and poorly cyrstalline, oxalate extractable). Phosphorus content of samples ranged from 550 to 2650 ppm, with the highest levels near the densest human habitation. Wet sediment samples had sorption indices between 3.2 and 120, mean 32.2; and dry sediments, 5.6 to 46.2, mean 17.1. (Cassar-FRC)
W81-03522

TECHNETIUM-99 CONTENT IN SOME MARINE ORGANISMS COLLECTED NEAR LA HAGUE, FRANCE,
CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses (France). Dept. de Protection.
For primary bibliographic entry see Field 5A.
W81-03524

RELATIONS OF SELECTED TYPES OF MICRO-ORGANISMS WITH THE VERNAL PHYTOPLANKTON BLOOM IN THE TVARMINNE AREA, SOUTHERN COAST OF FINLAND,
Zoological Station, Tvarminne (Finland).
P. Vaatanen.
Journal of Applied Bacteriology, Vol 49, No 3, p 463-469, December, 1980. 1 Fig, 1 Tab, 18 Ref.

Descriptors: *Yeasts, *Phytoplankton, *Eutrophication, Path of pollutants, Algae, Diatoms, *Finland, Tvarminne, Microorganisms, Salinity, Temperature, Bacteria, Sewage.

Biomass (chlorophyll a), yeasts, viable bacteria, and proteolytic bacteria were measured in almost daily water samples during March-June 1978 in the Tvarminne area, at the transition between the Gulf of Finland and the Baltic Sea. Two blooms occurred, one in early May and one about 2 weeks later. The heterotrophic bacteria population peaked shortly after each bloom, indicating that they utilized organic compounds released from decaying phytoplankton cells. Proteolytic bacteria reached a peak under the ice cover before the first bloom and declined thereafter. Their maximum was attributed to allochthonous types from fresh water and sewage. Yeast counts decreased as the algal bloom developed, being unable to compete with bacteria for nutrients, and were probably regulated by fresh water flows and mixing. Both proteolytic bacteria and yeast counts were negatively correlated with temperature and salinity. (Cassar-FRC)
W81-03542

UPTAKE, METABOLISM, AND ELIMINATION OF DIPHENYL ETHER BY TROUT AND STICKLEBACK,
Dalhousie Univ., Halifax, (Nova Scotia). Coll. of Pharmacy.
K. Wong, R. F. Addison, and F. C. P. Law.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 2, p 243-247, 1981. 5 Fig, 12 Ref.

Descriptors: *Trout, *Stickleback, *Metabolism, Industrial wastes, Diphenyl ether, Accumulation, Laboratory studies.

The accumulation and excretion of diphenyl ether by trout and stickleback were investigated. Characteristics of trout liver microsomal diphenyl ether 4-hydroxylase were also investigated. Uptake studies were carried out in an uptake tank containing 12 liters of stagnant and aerated fresh water at 9 degrees C. After the addition of 0.17 micromoles of C-14 labeled diphenyl ether, about 100 rainbow trout were put into the tank. Control fish were placed in another tank of fresh water without

diphenyl ether at the same temperature. The diphenyl ether was rapidly taken up by rainbow trout and stickleback. The amount of radioactivity accumulated by the fish increased with time of exposure to the chemical. After 8 hr of exposure, radioactivities accumulated by rainbow trout and stickleback were equivalent to 0.46 nmol and 1.7 nmol diphenyl ether per g wet weight, respectively. The rate of diphenyl ether hydroxylation by trout liver microsomes appeared to be low, at 288 nmol/g liver/hr. (Baker-FRC)
W81-03569

UPTAKE OF FLUORIDE BY RYEGRASS GROWN IN SOIL TREATED WITH SEWAGE SLUDGE,
Water Research Centre, Stevenage (England).
R. D. Davis.
Environmental Pollution (Series B), Vol 1, No 4, p 277-284, 1980. 2 Fig, 4 Tab, 17 Ref.

Descriptors: *Fluorides, *Toxicity, *Cattle, *Grasses, *Sewage sludge, Soil amendments, Sludge disposal, Ruminants, Range grasses, Fertilizers, Additives, Agricultural chemicals, Absorption, Ultimate disposal.

Ryegrass grown in pots receiving additions of sewage sludge containing 33,500 mg per kg dry weight of fluoride absorbed F in amounts which increased with rate of application. This sludge had F levels 16 times higher than an average sewage sludge. The largest quantity applied, 2408 ml sludge per pot, equivalent to 672 kg per hectare of F, produced an increase in soil F level of 304 mg per kg dry matter. Clippings from the first cut of ryegrass contained about 60 mg per kg F, dry basis. Levels of F decreased to about 33 mg per kg in the second cutting and to about 22 mg per kg in the third. Approximately 0.06% of the F applied to the soil was assimilated by the plants at the maximum application rate. The results suggest that a limit of 290 kg F per hectare can be added in one application without exceeding the toxic limit of 30 mg per kg. Although F taken up by grass can be a source of F ingested by cattle in a pasture, direct ingestion of sludge and contaminated soil is also an important factor. (Cassar-FRC)
W81-03578

POLYCHLORINATED BIPHENYLS IN THE SEDIMENTS AND FISH OF AN OKLAHOMA STREAM,
Corps of Engineers, Tulsa, OK.
R. G. Hunter, J. C. Randolph, and J. H. Carroll.
Environmental Pollution (Series B), Vol 1, No 3, p 233-240, 1980. 1 Fig, 4 Tab, 10 Ref.

Descriptors: *Water pollution sources, *Polychlorinated biphenyls, *Pulp wastes, Path of pollutants, Sediments, *Industrial wastes, Absorption, Freshwater fish, Water pollution effects, Water pollution, Natural streams, Pryor Creek, *Oklahoma.

A study was undertaken to document the pollution of Pryor Creek, Oklahoma with polychlorinated biphenyls (PCBs) from an industrial source. The PCBs enter the stream after rainfall causes erosion of the drying lagoons of a paper processing firm. The lagoons are poorly kept and contain a mixture of clay and paper pulp containing PCBs from pulp processing chemicals. PCB levels in the sediments ranged from 0.23 to 7.2 micrograms/gram, but no PCB pollutants were found in the water. Sediment PCB levels were not correlated with downstream distance from the source of pollution. At areas of increased sediment deposition, PCB concentrations were significantly greater. PCB levels in fish fillets were significantly less in omnivores and predators than in detritivores. In two different fish species, PCB levels in fillets were significantly correlated with either lipid content, body weight or both. PCB concentration factors ranged from 0.319 for white crappie to 10.319 for river carpsucker. (Geiger-FRC)
W81-03579

A LABORATORY INVESTIGATION OF HEAVY METAL ADSORPTION ON MARINE DREDGE SPOILS,
Smith Coll., Northampton, MA. Dept. of Chemistry.
For primary bibliographic entry see Field 2L.
W81-03588

AEOLIAN SKY PACKAGED CHEMICALS POLLUTION INCIDENT,
Buckinghamshire Coll. of Higher Education, High Wycombe (England). Science and Environmental Studies School.
T. R. Dixon, and T. J. Dixon.
Water Pollution Bulletin, Vol 12, No 2, p 53-56, February, 1981. 1 Fig, 2 Tab, 1 Ref.

Descriptors: *Ships, *Accidents, *Hazardous materials, Pesticides, Safety, Beaches, Transportation, Agricultural chemicals, Herbicides, Disinfectants, Labeling, Liability, Regulations, *Chemical spills, Path of pollutants.

The Aeolian Sky collided on November 3, 1979 with another vessel in the English Channel and sank off St. Alban's Head. At the time of the accident the Aeolian Sky was carrying a general cargo containing 84 hazardous substances including pesticides, herbicides, disinfectants, and general laboratory chemicals. A total of 1500 chemical packages were recovered from the beaches of the Isle of Wight, where they arrived at the rate of 60/day following spells of strong onshore winds. Twenty people were taken to the hospital for precautionary medical examinations or treatment following contact with opened or leaking chemical packages. Clearance operations were organized by County and District Authorities in consultation with the Marine Pollution Control Unit. Emergency control centers were established in each of the affected counties. Systematic searches of beaches for chemical packages were conducted. It is suggested that delay in reporting the accident contributed to the final loss of the vessel. The accident may have occurred due to the use of outdated sea charts to cross the English Channel. (Baker-FRC)
W81-03590

5C. Effects Of Pollution

IDENTIFICATION OF THE WATER QUALITY FACTORS WHICH PREVENT FINGERNAIL CLAMS FROM RECOLONIZING THE ILLINOIS RIVER, PHASE II,
Illinois Natural History Survey, Havana. River Research Lab.
For primary bibliographic entry see Field 5A.
W81-03257

CALIFORNIA STATE MUSSEL WATCH, TRACE METAL CONCENTRATIONS AND SYNTHETIC ORGANIC COMPOUNDS IN THE CALIFORNIA MUSSEL, MYTILUS CALIFORNIANUS, AND THE BAY MUSSEL, M. EDULIS,
California State Dept. of Fish and Game, Monterey.
M. D. Stephenson, M. Martin, S. L. Coale, D. Crane, and T. Lew.
California State Water Resources Control Board, Sacramento Water Quality Monitoring Report 80-8, December, 1980. 134 p, 27 Fig, 30 Tab, 29 Ref, 6 Append.

Descriptors: *California, *Mussels, Minerals, Water quality, Marine animals, Outfall sewers, Marine environment, Environmental effects, *Water pollution effects, Marine biology, Water pollution sources, Ocean dumping, Water sampling, *Organic compounds, *Trace elements, Coastal waters, Harbors, Bays.

This two-part report surveys trace metal concentrations (Part I) and synthetic organic compounds (Part II) in California mussels. The State Mussel Watch (SMW) Marine Monitoring Program documents and assesses indicators of water quality in coastal marine and estuarine areas. In the third year (1979-80) of SMW, chromium, copper, lead, manganese, mercury, nickel, silver, and zinc were analyzed in mussels collected from 12 open coastal sites. From data collected at 24 bay stations, it appears that mussel tissue concentrations of copper, lead, and zinc are correlated, as are cadmium, chrome, and nickel. An analysis of archive samples collected nine years ago suggests that lead levels have increased. Other metals have not decreased substantially. Part II presents data on two species of mussels collected in 1979 from 32 resident and 16 transplanted mussel monitoring stations in California. The samples were analyzed for 56 synthetic organic hydrocarbons, using glass capillary gas chromatography. Evidence of chlorinated hydrocarbons was found in mussel samples from various locations. Levels of DDT, PCB, and Chlordane were higher than recorded in previous studies. The suitability of mussels as the indicator organism for persistent pollutants, specifically trace metals and hydrocarbons, stems from several factors: (1) their ubiquity along the California coast; (2) their ability to concentrate pollutants; and (3) their sessile nature. (Garrison-Omniplan)
W81-03285

THE FISHES OF THE ADIRONDACK PARK,
Union Coll., Schenectady, NY. Dept. of Biological Sciences.
C. J. George.
New York State Department of Environmental Conservation Report, August, 1980. 94 p, 7 Tab, 253 Ref.

Descriptors: *New York, *Fish populations, *Lake fisheries, Fish management, Fish conservation, Fisheries, *Fishkill, Fish harvest, Aquatic animals, Sport fishing, *Acid rain, Insecticides, *Adirondack Park.

This review of the ichthyology of the area of the Adirondack Park contained within the 'Blue Line' centers on biological surveys of the six major watersheds of the study area done in 1930-35. The total area of 9,261 square miles contains 2,000-3,000 water bodies. The ichthyofauna consists of 96 forms, including four kinds of hybrids commonly produced and used in stock programs; of the remaining 92 forms, 23 may be classified as boreal or peri-glacial. The Atlantian group consists of 20 species and the Mississipian and adjacent Pleistocene refugia have provided about 45 members of the fauna. Two of the fauna are the rainbow and steelhead trout and the kokanee salmon, introduced from the west coast; three species are from the old world. Spraying for insect control, introduction of exotic plant species, and acid precipitation have all measurably impacted fish populations in recent years, often in complex and synergistic ways. For example, a decline of fish populations in Big Moose Lake is probably the complex result of present and past lumbering, fishing, stocking, forest fires and hurricane damage, as well as acid precipitation. As the system diversifies, many populations of boreal forms are being lost, and new forms of Atlantian and Mississipian heritage are being established. (Garrison-Omniplan)
W81-03286

ACIDITY STATUS OF LAKES IN THE ADIRONDACK REGION OF NEW YORK IN RELATION TO FISH RESOURCES,
New York State Dept. of the Environmental Conservation, Albany. Bureau of Fisheries.
M. H. Pfeiffer, and P. J. Festa.
Report, August, 1980. 36 p, 20 Fig, 3 Tab, 4 Ref, 3 Append.

Descriptors: *New York, *Mountain lakes, *Acid rain, Chemical properties, Acidity, Lakes, *Ponds, Acidic water, Alkalinity, Fish conservation, Lake fisheries, Geologic units, Hydrogen ion concentration, Fish populations, *Adirondack region.

As a result of extensive glacial activity, the Adirondack region of northeastern New York State contains approximately 2,900 individual lakes and ponds, encompassing approximately 282,000 surface areas. Many of these surface waters have low alkalinities due to a carbonate-poor geology; therefore, they are particularly sensitive to the high acid ion deposition associated with the region's airshed. Since 1975, pH and alkalinity measurements have been made on 849 ponded waters throughout the region to determine the scope of water quality

impacts associated with acid ion deposition and to provide a baseline inventory for indexing future measurements. The present condition of surface waters is described on the basis of summertime, one meter depth, and pH measurements obtained with a pH meter under air-carbon dioxide-equilibrium conditions. Twenty-five percent of the waters in the survey, comprising 10,460 surface acres, registered pH readings below 5.0. Comparisons of historic and post-1974 acidities are made where data points from comparable methodologies exist. Relationships between meter pH, colorimetric pH, alkalinity, conductivity, calcium, lake surface area, lake surface elevation, and geographical location are discussed. Changes in fish species composition and sportfishing yields observed in waters exhibiting increased acidity are reviewed. (Garrison-Omniplan)
W81-03287

SOME PHYSICAL, CHEMICAL, AND BIOLOGICAL CHARACTERISTICS OF NON-PROBLEM WATERS OCCURRING ON LANDS SURFACE-MINED FOR COAL,
Southern Illinois Univ. at Carbondale. Cooperative Wildlife Research Lab.
J. Konik.
Illinois Institute of Natural Resources, Chicago. Document No 80/14, July, 1980. 90 p, 22 Fig, 8 Tab, 74 Ref, 2 Append.

Descriptors: *Illinois, *Strip mine lakes, *Water quality, *Aquatic life, Strip mines, Lake basins, Aquatic habitats, Light penetration, Lake morphometry, Coal mines, Data collections, Zooplankton, Macrophytes, Acidic water, Dissolved oxygen, Artificial lakes.

Extensive acreages of wetlands have come into existence as a consequence of surface mining. Several regions now have ponds and lakes where none previously existed. Generally, the potential and/or actual consequences of surface mining are not fully appreciated. This study was designed to characterize selected physical, chemical and biotic parameters of six prelaw, non-problem surface mine ponds in Illinois with biotic emphasis on invertebrates and algae. Two types of ponds were selected: those formed by the accumulation of water between spoilbanks (Type A), and those resulting from filling final cuts and associated haul roads with subsurface and surface draining (Type B). Ponds with the lowest specific conductance, lowest total hardness, and lowest sulfate concentrations typically had the greatest diversity of freshwater invertebrates, algae, and aquatic macrophytes. No differences in water chemistry or biotic diversity were observed between Type A and Type B lakes. All ponds showed fish and wildlife utilization. The range of pH was 6.15 to 8.32, with all ponds having values for specific conductance, total hardness, and sulfate higher than typically found in natural waters. All ponds underwent a period of thermal stratification and complete mixing during the one-year period of study. Water impoundments created by surface mining for coal should be recognized as viable and desirable contributions in conjunction with reclaiming mined land to row crop production. These bodies of water provide much needed wetland habitat, which is being replaced by the monotonous habitat characteristic of mono-agriculture. (Garrison-Omniplan)
W81-03292

SEDIMENT BIOASSAY,
Environmental Protection Agency, Chicago, IL. Central Regional Lab.
For primary bibliographic entry see Field 5A.
W81-03305

SEVERE GAS BUBBLE DISEASE IN A WARM-WATER FISHERY IN THE MIDWESTERN UNITED STATES,
Missouri Dept. of Conservation, Columbia.
R. L. Crunkilton, J. M. Czarnezki, and L. Trial.
Transactions of the American Fisheries Society, Vol 109, No 6, p 725-733, November, 1980. 3 Fig, 2 Tab, 25 Ref.

Descriptors: *Supersaturation, *Fishkill, *Fish diseases, Dams, Shad, Nitrogen, Lakes, Rivers, Osage River, *Missouri, Harry S. Truman Dam, Gas bubble disease.

The effects of gas supersaturation on a warmwater fishery are discribed. Gas bubble disease below the Harry S. Truman Dam, sited on the upper Osage River and spilling into Lake of the Ozarks, caused the largest fish kill on record in Missouri in May 1978. Total gas saturation levels were up to 139% and killed nearly a half million fish in the upper 85 km of the Osage Arm, Lake of the Ozarks. The kill was 85% gizzard shad, 9% white bass, and 3% freshwater drum. After a major kill, living fish were sampled below the dam, and 47% of them showed symptoms of gas bubble disease. The problem seemed to be heightened during periods of higher temperatures. Nitrogen was the primary gas responsible for gas bubble disease mortalities. In general, pelagic and near-shore species suffered the earliest and heaviest mortalities, but fish of deeper waters were killed when the supersaturation persisted. Instream cage bioassays were used to define the zone of lethal supersaturation. Significant mortality occurred in bottom-dwelling fish of several species due to long-term, perhaps intermittent, exposure. Susceptibility to gas bubble disease was related to fish size. (Small-FRC)
W81-03387

IMPLICATIONS OF SHORT-TERM PCB UPTAKE BY SMALL ESTUARINE COPEPODS (GENUS ACARTIA) FROM PCB-CONTAMINATED WATER, INORGANIC SEDIMENTS AND PHYTOPLANKTON,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
K. D. Wyman, and H. B. O'Connors, Jr.
Estuarine and Coastal Marine Science, Vol 11, No 2, p 121-131, August, 1980. 5 Fig, 24 Ref.

Descriptors: *Polychlorinated biphenyls, *Phytoplankton, *Toxicity, Absorption, *Copepods, Sediments, Acartia, Water pollution effects, Aquatic life, Aquatic animals, Invertebrates, Zooplankton, Path of pollutants, Food chains.

Adult copepods (Acartia) accumulated C14 labeled polychlorinated biphenyls (PCB) at a much faster rate from contaminated phytoplankton than from water containing PCB alone or PCB-contaminated inorganic sediments. Whereas PCB levels in copepods exposed to contaminated water or inorganic sediments reached an equilibrium in 36 hours, the maximum accumulation was reached in 5 hours when contaminated phytoplankton were present. Results of this rapid response are significant because PCB may be rapidly transported to the water column and sediments via fecal pellets, may cause increases in PCB in the next trophic level, and affect mortality and fecundity of the copepods. When Acartia were exposed to PCB at a level of 1 ppb, significant mortality with time occurred; no noticeable differences were seen between copepods with and without food present. Sharper differences were noted at concentrations of 5 and 10 ppb, where the presence of phytoplankton caused earlier and greater mortality than in plain water at the same concentrations. At 20 ppb the toxicity of PCB was great enough to kill all the animals after 30 hours exposure, whether or not food was present. In this experiment, the concentration of PCB on the phytoplankton was about 280 ppm dry weight. (Cassar-FRC)
W81-03389

HORMESIS: A RESPONSE TO LOW ENVIRONMENTAL CONCENTRATIONS OF PETROLEUM HYDROCARBONS,
California Univ., Berkeley.
R. B. Laughlin, Jr., J. Ng, and H. E. Guard.
Science, Vol 211, No 4483, p 705-707, February, 1981. 3 Fig, 19 Ref.

Descriptors: *Oil, *Hydrocarbons, *Aquatic life, Crabs, Hormesis, Oil spills, Shellfish, Environmental effects, Ecology.

Possible lasting harmful effects resulting from short-term exposures to pollutants were investigated using the zoeal larvae of the mud crab, exposed to water soluble fractions of jet fuel for either the first 5 days of the stage or for the duration of zoeal development, which is 11 to 14 days. The salinity of the water, concentration of the fuel, and length of exposure each affected the survival of the zoeae. Short-term exposure or continuous exposure to low concentrations of petroleum hydrocarbons caused no increase in mortality or changes in the development rate, and increased megalopal weight was characteristic of such groups. This phenomenon is termed 'hormesis' and has seldom been reported as a generalized aspect of environmental stress etiology. These experiments suggest an organismic resilience to episodic oil-spill incidents. It is felt that many marine organisms have compensatory physiological strategies that enable them to tolerate low concentrations of pollutants or short term exposures. (Baker-FRC)
W81-03396

HEAVY METALS IN A STREAM ECOSYSTEM AT SITES NEAR HIGHWAYS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Sciences.
J. H. Van Hassel, J. J. Ney, and D. L. Garling, Jr.
Transactions of the American Fisheries Society, Vol 109, No 6, p 636-643, November, 1980. 2 Fig, 3 Tab, 42 Ref.

Descriptors: *Heavy metals, *Fish, *Highway effects, Environmental effects, Highways, Roads, Runoff.

This study was designed to determine if highway proximity and traffic density influenced the heavy metal content of water, sediment, benthos, and fish in a soft-water stream. The study area was Back Creek, a second-order tributary to the Roanoke River located in a montane region of southwest Virginia. The watershed is lightly populated, with no industrial or domestic effluents entering the system upstream or in the study area. Streamwater concentrations of all four metals tested (lead, zinc, cadmium, and nickel) were always well within the ranges reported for relatively uncontaminated surface waters. However, progressively higher heavy metal concentrations were noted in the sediment, benthos and fish of Back Creek at sites of increasing traffic density, indicating that highways were a source of contamination. Benthic invertebrates generally contained higher concentrations of heavy metals than fish. Trophic level biomagnification was not seen among the benthic invertebrates or between them and the benthophagic fish. It is suggested that long term field investigations of community dynamics would more directly indicate the threat to aquatic ecosystems posed by highway generated heavy metal contamination. (Baker-FRC)
W81-03413

CRITICAL THERMAL MAXIMA OF FIVE TROUT SPECIES IN THE SOUTHWESTERN UNITED STATES,
Arizona State Univ., Tempe. Dept. of Zoology.
R. M. Lee, and J. N. Rinne.
Transactions of the American Fisheries Society, Vol 109, No 6, p 632-635, November, 1980. 1 Tab, 25 Ref.

Descriptors: *Survival, *Trout, *Water temperature, Temperature, Fish populations, Growth, Fishing, Fish, Climate.

The study was designed to indicate through laboratory experiments the thermal limits of natural waters suitable for restocking native trout, to demonstrate whether thermal barriers could be used to segregate native trout from the more competitive trout species, and to determine if thermal tolerances might aid in the resolution of systematics and taxonomy of populations of southwestern trout species. The critical thermal maximum (CTM) was determined for five trout species and found to be remarkably similar. For acclimation temperatures of 10C, the mean species CTM's differed by only 0.7C at most. When acclimation temperatures were 20C, the CTM for each species increased about 1C, with a range of only 0.5C among the species. Under fluctuating temperature regimes, lethal tem-

peratures were lower because the fish were subjected to elevated temperatures for longer periods of time. The findings suggest that adult rainbow, brown, and brook trout are as well adapted to elevated water temperatures found in the southwestern United States as are the adult Gila and Arizona trout which are native to that area. (Baker-FRC)
W81-03416

THE IMPORTANCE OF A REEF-FORMING POLYCHAETE, MERCIERELLA ENIGMATICA FAUVEL, IN THE OXYGEN AND NUTRIENT DYNAMICS OF A HYPEREUTROPHIC SUBTROPICAL LAGOON,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
W. C. Keene, Jr.
Estuarine and Coastal Marine Science, Vol 11, No 2, p 167-178, August, 1980. 4 Fig, 2 Tab, 29 Ref.

Descriptors: *Lagoons, *Reefs, *Eutrophication, Nutrients, Tunis Lake, Polychaetes, *Africa, Sedimentation, Oxygen, Respiration, Nitrogen compounds, Phosphates, Aquatic plants, Aquatic life, Water pollution effects, Productivity, Aquatic productivity.

The polychaete, Mercierella enigmatica Fauvel, is a major contributor to the eutrophication of Lac de Tunis, North Africa, through its rapid nutrient recycling mechanism and reef formation, which promotes sedimentation and prevents water exchange. The broad, shallow and hypersaline lagoon receives municipal wastes and supports large populations of aquatic plants and reef-building polychaetes. Portions of the reef were enclosed in plexiglass walls open to the atmosphere for 6 experiments during Dec. 1976 to April 1977. For a 24 hour period water quality parameters were measured each 2 hours. Typically, respiration rates for active periods were 0.24 to 0.53 g oxygen per sq meter per hour, and for inactive periods, 0.04 to 0.13. Very high respiration rates (1.17) were measured on one occasion during strong midday winds. Active nitrogen release rates were 1.45 and 1.72 mmol N per sq meter per hr in Nov. and Dec. respectively; phosphate, 0.13 and 0.09. Reef respiration represented a large oxygen sink, averaging 5.8 g oxygen per sq meter per day. Although direct evidence suggests that the polychaetes are primarily responsible for this respiration and nutrient exchange, other studies indicate that under aerobic conditions the adjacent benthic community had little effect on water chemistry. Even if sewage input were to be eliminated, it could be expected that this lagoon would continue to receive nutrient input from the sediment and the polychaetes. (Cassar-FRC)
W81-03419

AN EXAMINATION OF CD, CU, AND HG CONCENTRATIONS IN LIVERS OF NORTHERN PIKE, ESOX LUCIUS, AND WHITE SUCKER, CATOSTOMUS COMMERSONI, FROM FIVE LAKES NEAR A BASE METAL SMELTER AT FLIN FLON, MANITOBA,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
G. A. McFarlane, and W. G. Franzin.
Canadian Journal of Fisheries and Aquatic Science, Vol 37, No 10, p 1537-1578, October, 1980. 1 Fig, 4 Tab, 13 Ref.

Descriptors: *Fish, *Cadmium, *Copper, *Mercury, Metals, Freshwater fish, Pikes, Suckers, Aquatic animals, Zinc, Smelters, Lakes, Water pollution effects, Lake sediments, Pollutant identification, Industrial wastes, Flin Flon, *Manitoba, Heavy metals.

The concentrations of Cd, Cu, and Hg in livers of two species of fish, northern pike and white sucker, from 5 lakes near a base metal smelter at Flin Flon, Manitoba, were determined. The waters and sediments of the lakes varied in metal concentrations, Zn and Cu being higher than the other metals. Concentrations of Cd increased with age in both species, but Cu and Hg concentrations increased with age only in pike livers. This suggests that the main Cd uptake route is the water, rather than the diet. Concentrations of metals in liver could not be correlated with any one or combinations of environmental variables. High Ca levels in the water were associated with lower metal concentrations in livers. (Cassar-FRC)
W81-03422

TOXICITY OF VOLCANIC-ASH LEACHATE TO A BLUE-GREEN ALGA. RESULTS OF A PRELIMINARY BIOASSAY EXPERIMENT,
Geological Survey, Denver, CO.
D. M. McKnight, G. L. Feder, and E. A. Stiles.
Environmental Science and Technology, Vol 15, No 3, p 362-364, March, 1981. 2 Fig, 1 Tab, 9 Ref.

Descriptors: *Air pollution, *Volcanoes, *Algae, Cyanophyta, Anabaena, Water pollution effects, *Mt. St. Helens, Washington, Copper, Aquatic plants, Trace elements, Metals, Toxicity, Volcanic-ash leachate.

Ash from the Mt. St. Helens, Washington, volcanic eruptions could adversely affect aquatic ecosystems. Leachate from the ash, obtained by leaching 151 g ash with 130 ml water, killed Anabaena flos-aquae cultures at a dilution of 1:100 leachate-culture medium. Algae grew in a 1:500 dilution, but filaments were structurally abnormal. Ash leachate contained (in mg per liter) Ca, 188.6; Mg, 31.7; Na, 120.5; and Sr, 0.86. Trace metals (in micrograms per liter) were Fe, 44; Cu, 115; Cd, 20; Mn, 4460; Zn, 739; Co, 40; Li, 158; Mg, 11; and Pb, 12. Comparisons with Cu toxicity experiments indicate that growth inhibition was caused by a metal other than Cu, by synergism of trace metals, or by toxic organic compounds. (Cassar-FRC)
W81-03449

EFFECTS OF THREE PHOSPHORUS FERTILIZERS ON PHOSPHORUS CONCENTRATIONS AND PHYTOPLANKTON PRODUCTION,
Auburn Univ., Alabama. Dept. of Fisheries and Allied Aquacultures.
C. E. Boyd, Y. Musig, and L. Tucker.
Aquaculture, Vol 22, No 1/2, p 175-180, January, 1981. 5 Fig, 1 Tab, 5 Ref.

Descriptors: *Phosphorus compounds, *Aquaculture, *Fertilizers, Phytoplankton, Nutrients, Phosphates, Fish farming, Nitrates, Nitrogen compounds, Ponds, Chlorophyll, Water pollution effects.

Liquid fertilizers were more effective in increasing phosphorus concentration and phytoplankton production in pools than granular fertilizers. The following treatments, equal in N and P content, were applied four times during the season to earthen ponds and earth-mud systems in plastic pools: granular triple superphosphate with ammonium nitrate, liquid Poly N (ammonium polyphosphate and ammonium nitrate), and granular diammonium phosphate. In earthen ponds, chlorophyll a production increased from about 25 ng per liter to 62 for Poly N and 47-48 for the granular fertilizers. Dissolved triple superphosphate produced greater total phosphorus concentration than granular triple superphosphate. Tests of Poly N at three rates, standard, 2/3, and 1/3, indicated that the 1/3 application rate produced chlorophyll a concentrations a little lower than triple superphosphate granules at the standard rate. (Cassar-FRC)
W81-03465

THE EFFECT OF ENVIRONMENTAL ORIGIN ON THE RESPONSE OF MARINE DIATOMS TO CHEMICAL STRESS,
Woods Hole Oceanographic Institution, MA.
L. S. Murphy, and R. A. Belastock.
Limnology and Oceanography, Vol 25, No 1, p 160-165, January, 1980. 1 Fig, 3 Tab, 13 Ref.

Descriptors: *Diatoms, *Chemical wastes, Industrial wastes, Toxicity, Water pollution effects, Chemical wastewater, Aquatic life, *Estuaries, Algal growth.

The stressed growth rates of estuarine clones from polluted and relatively unpolluted environments were compared with oceanic clones of the same species. Seventeen clones of the marine diatoms Thalassiosira pseudonana and Skeletonema costatum were studied. A wide range of sensitivities to industrial pollution wastes was demonstrated. Eight clones examined were of oceanic origin; nine were neritic. Three of the 9 neritic clones were from heavily polluted estuaries and 6 were from relatively unpolluted waters. It was concluded that clones from the polluted estuaries were less sensitive to industrial DuPont Grasselli waste than were clones of the same species which had been residing in relatively unpolluted environments. Neritic and oceanic clones showed broadly overlapping responses to chemical stress tests, with the exception of those from the heavily polluted areas. It was noted that the short term pollution history of the original environment is at least as important a factor in determining sensitivity of a clone as is the long term stability and predictability of that environment. (Baker-FRC)
W81-03473

A REVIEW OF DISSOLVED GAS SUPERSATURATION LITERATURE,
Parametrix, Inc., Bellevue, WA.
D. E. Weitkamp, and M. Katz.
Transactions of the American Fisheries Society, Vol 109, No 6, p 659-702, November, 1980. 1 Tab, 213 Ref.

Descriptors: *Supersaturation, *Fish diseases, *Literature review, Nitrogen, Life cycles, Temperature effects, Case studies, Hydraulic structures, Water pollution effects, Gas bubble disease.

A literature review is presented of articles on dissolved gas supersaturation, a condition that results from natural and human-caused processes. Supersaturation can cause gas bubble disease, which has occurred in a wide variety of fishes and invertebrates. The causes are discussed, as well as the organisms affected, factors affecting susceptibility of aquatic organisms, and other related topics. The role of nitrogen partial pressures versus total dissolved gas pressure in causing the disease is treated extensively. The tolerance of various species to supersaturation has been investigated. Tolerance studies have investigated the effects of life stage, temperature, and genetics on development of the disease in fish. Case histories have been compiled, including the famous Columbia River incidents. Various solutions to the problem have been suggested, including passing water through baffles placed at the head of a trough and spillway deflectors. (Small-FRC)
W81-03476

COAL AND COAL MINE DRAINAGE,
Tennessee Valley Authority, Chattanooga.
H. Olem.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1415-1429, June, 1980. 141 Ref.

Descriptors: *Coal mine wastes, *Mine wastes, *Acidic water, Water quality, Drainage water, Strip mine wastes, Regulations, Leachate, Aquatic life, Ecology, Environmental effects, Waste treatment, Water pollution effects, Water pollution control, Reviews, Industrial wastes.

The impact of coal wastes and coal mine drainage on the environment is reviewed as presented in recent published papers. Projections on effects of increased coal usage, the 1977 Clean Water Act, the 1977 Surface Mining Control and Reclamation Act, and other legislation and regulations are discussed. Articles on coal mining include the subjects: formation of mine drainage, effects of acid mine drainage on water quality and aquatic life, treatment of mine drainage water using lime-limestone, the biochemical fuel cell principle, low pressure ultrafiltration, reverse osmosis, ion exchange, and sedimentation. Prevention and control of pollution is included. Papers on wastes produced in coal cleaning operations and coal transportation and storage are also considered. (Cassar-FRC)
W81-03477

ELECTROPLATING AND CYANIDE WASTES,

Argonne National Lab., IL. Energy and Environmental Systems Div.
For primary bibliographic entry see Field 5D.
W81-03481

EUTROPHICATION,
Connecticut Univ., Storrs.
A. J. Medine, and D. B. Porcella.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1511-1519, June, 1980. 80 Ref.

Descriptors: *Eutrophication, *Lakes, *Nutrients, Phosphorus compounds, Phytoplankton, Reviews, Aquatic plants, Great Lakes, Water pollution effects, Sediments, Model studies, Water quality, Planning.

A review of recent literature on eutrophication discusses nutrient loading relationships, correlations between parameters (primary production, chlorophyll, photosynthesis, transparency, and nutrient loading), and indices of eutrophication (oxygen deficit, areal hypolimnetic oxygen deficit, summer mean and maximum chlorophyll a, and underwater light penetration). Several papers on modeling of eutrophication and ecosystems (especially in the Great Lakes) were useful for evaluating planning alternatives for water quality problems and for understanding interacting processes. Sources of nutrients, particularly phosphorus compounds, are tributaries, abandoned farm fields, urban areas, groundwater, atmospheric deposition, and biological/physical/chemical processes in sediments and in lake water. Included in this review are the effects of nutrients on phytoplankton, phytoplankton-macrophyte dynamics, and restoration of eutrophied lakes. (Cassar-FRC)
W81-03486

MARINE AND ESTUARINE POLLUTION,
California State Univ., Long Beach.
D. J. Reish, G. G. Geesey, T. J. Kauwling, F. G. Wilkes, and A. J. Mearns.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1533-1575, June, 1980. 5 Tab, 485 Ref.

Descriptors: *Pesticides, *Marine animals, *Microorganisms, *Toxicity, Heavy metals, Oil pollution, Pesticide residues, Literature review, Analytical techniques, Pollutant identification, Food chains, Biodegradation, Effluents, Sludge disposal, Birds, Aquatic life, Water pollution effects, Invertebrates, Marine biology, Bacteria, Pathology, Microbial degradation, Organic compounds, Phytoplankton.

A review of several hundred recent articles on marine and estuarine pollution begins with a book on invertebrates as indicators of pollution and several general reviews. Effects of pesticides on marine life are summarized in several EPA reports, bibliographies, and review articles. Individual papers discuss methods for identifying pesticide residues, the acute and sublethal effects of pesticides on marine organisms (surveyed in a table), bioaccumulation, pesticide residues (summarized in a table according to chemical, organism species, location, and concentration), metabolism, and fate. Microorganisms, both as pollutants and as agents for pollutant biodegradation, are listed in tabular form. A table relates selected elements, including heavy metals, with organism, concentration and locality. Effects of complex mixtures such as industrial effluents and combinations of pollutants are described. Surveys, both baseline and in polluted areas, include many organisms and locations. Other topics in this review are disease and pathology of marine organisms affected by pollutants and effects of dredging, dumping, and waste water sludge. Much information on oil pollution has been published--90 papers from the 1979 Oil Spill Conference; methods of determining hydrocarbons in marine materials; residues found in waters, sediments, flora, and fauna; the role of microorganisms and dispersants in cleaning up spills; and toxicity to aquatic life and birds. (Cassar-FRC)
W81-03488

ENTRAINMENT AND IMPINGEMENT AT COOLING WATER INTAKES,
Oak Ridge National Lab., TN. Ecological Sciences Information Center.
M. S. Uziel.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1616-1630, June, 1980. 106 Ref.

Descriptors: *Aquatic life, *Intakes, *Entrainment, Fish behavior, Fish control, Impingement, Screens, Cooling water, Powerplants, Phytoplankton, Fish passages, Model studies, Sampling, Literature review, Estuaries.

The problem of entrainment and impingement of aquatic life at cooling water intakes is reviewed. In addition to general reviews and bibliographies on the subject, many modeling studies are summarized. Other subjects include sampling techniques for fish populations; site studies at power plants in both marine and freshwater systems in the U.S. and foreign countries; and design of intake systems, screens, and fish passages for minimizing impact on aquatic life. Laboratory studies simulated entrainment, measured swim speed of various fish species, and observed fish behavior. (Cassar-FRC)
W81-03489

EFFECTS OF POLLUTION ON FRESHWATER INVERTEBRATES,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
A. L. Buikema, Jr., and E. F. Benfield.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1670-1686, June, 1980. 3 Tab, 175 Ref.

Descriptors: *Invertebrates, *Toxicity, *Organic compounds, Metals, Water pollution effects, Daphnia, Literature review, Pesticides, Copepods, Amphipoda, Isopods, Insects, Mollusks, Rotifers, Worms, Crayfish, Bioindicators, Protozoa, Cladocerans.

A literature review of 1979 work on the effects of water pollution on freshwater invertebrates includes a number of review papers. Research on sublethal effects of toxic chemicals on different invertebrates species is plentiful. Controlled systems such as artificial communities have been used to study the ecological fate of several pesticides and arsenic. Tables list the acute and chronic effects of chemicals to Daphnia magna and the effects of Cu and Ni as a function of water hardness on Daphnia pulicaria. The text provides many more examples of toxicity tests, using Cladocerans as bioindicators. Other animals used in toxicity tests are copepods, crayfish, amphipods, isopods, insects, mollusks, rotifers, worms, and protozoans. Chemicals used on these species include a variety of metals, pesticides, industrial wastes, petroleum fractions, and organic compounds. (Cassar-FRC)
W81-03491

FRESHWATER MACROINVERTEBRATES,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
T. F. Nalepa, and M. A. Quigley.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1686-1703, June, 1980. 198 Ref.

Descriptors: *Invertebrates, *Insects, *Bioindicators, Habitats, Aquatic fauna, *Water pollution effects, Literature review, Wastes, Sediments, Benthic fauna, Sampling, Monitoring.

A literature review discusses 1979 papers on the effects of water pollution and habitat alterations on macroinvertebrates. Work is continuing on invertebrates as bioindicators of pollution, the effects of organic and other wastes (septic effluents, farm wastes, and mine wastes), and the impact of environmental alterations (thermal discharges, entrainment in power plant water intakes, stream channelization, logging, and construction). Many other subjects are being explored by various authors: distribution and habitat requirements, production and growth, food preferences and feeding behavior, periodicity and drift (particularly insects), interaction between animals and sediment, and methods of sampling in the benthos and water. (Cassar-FRC)
W81-03492

EFFECTS OF POLLUTION ON FRESHWATER FISH,
Environmental Research Lab., Duluth, MN.
R. L. Spehar, R. W. Carlson, A. E. Lemke, D. I. Mount, and Q. H. Pickering.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1703-1768, June, 1980. 1 Tab, 401 Ref.

Descriptors: *Freshwater fish, *Toxicity, *Effluents, *Organic compounds, *Heavy metals, Water pollution effects, Fish, Pesticides, Literature review, Bioassay, Herbicides, Insecticides, Water quality, Dissolved oxygen, Oxygen, Aquatic animals, Aquatic life, Sedimentation, Industrial wastes, Chlorination, Pulp and paper industry, Dam construction, Impoundments, Land use, Acidic water, Lakes, Rivers.

The 1979 literature on the effects of pollution on freshwater fish is reviewed. In addition to individual papers, there were many reviews and symposia presented covering all phases of fish toxicology. A 16-page table summarizes the acute and chronic toxicity of inorganic pollutants to freshwater fish, listing pollutant, species, results, type of exposure, temperature, and pH and hardness of the water. This is accompanied by a discussion divided into the topics of dissolved gases (oxygen, ozone, ammonia, carbon dioxide, etc.), pH (or response to acidified rainfall), and chemical pollutants (insecticides, herbicides, inorganics, heavy metals, polychlorinated biphenyls, crude oil and derivatives, surfactants, solvents, polyaromatic hydrocarbons, and many others). The effects of industrial and municipal effluents on fish are presented, including chlorinated water and pulp and paper wastes. The impact of physical factors is also discussed. This includes the introduction of exotic species, dam construction, land use, and sedimentation. (Cassar-FRC)
W81-03493

EARLY FOULING BIOFILM FORMATION IN A TURBULENT FLOW SYSTEM: OVERALL KINETICS,
Rhode Island Univ., Kingston.
J. Bryers, and W. Characklis.
Water Research, Vol 15, No 4, p 483-491, April, 1981. 14 Fig, 1 Tab, 26 Ref.

Descriptors: *Fouling, *Mathematical studies, *Turbulent flow, Growth kinetics, Electric powerplants, Films, Thin films, Biocontrol, Kinetics, Heat transfer, Heat resistance, Fluid friction, Microorganisms, Chemical oxygen demand, Biomass.

Fouling of electric power surface-condensers costs the United States power industry approximately $400 million/year in additional fuel. Research was conducted to develop a biofilm detection method sensitive to the early stages of biofilm formation in turbulent flow systems and to formulate an expression for the net biofilm accumulation rate as a function of microbial activity and hydrodynamic parameters during the early stages of formation. An empirical expression was devised to describe the rate of fouling biofilm development from clean surface conditions to the beginning of increased fluid frictional resistance. A continuous stirred tank reactor with an internal recycle circuit was used for the experiments to simulate turbulent flow and to allow control of the biological activity in the bulk fluid. The primary biofilm accumulation rate was defined by a first order expression in which the rate coefficient was dependent upon the concentration of the suspended biomass, Reynolds number, and growth rate of suspended biomass. Experimental results showed that a decrease in initial biofilm accumulation occurred with increasing Reynolds number, suggesting that particle flux from the bulk fluid is one rate process which contributes to the net biofilm COD accumulation. (Geiger-FRC)
W81-03494

DISTRIBUTION OF HYDROCARBONS IN THE OYSTER, PINCTADA MARGARATIFERA, ALONG THE COAST OF KUWAIT,

Kuwait Inst. for Scientific Research.
V. C. Anderlini, L. Al-Harmi, B. W. De Lappe, R. W. Risebrough, and W. Walker.

Marine Pollution Bulletin, Vol 12, No 2, p 57-62, February, 1981. 4 Fig, 3 Tab, 12 Ref.

Descriptors: *Hydrocarbons, Oil tankers, *Coastal waters, Oil industry, *Oil pollution, Oil spills, Water pollution effects, *Oysters, *Kuwait.

A survey was undertaken to obtain preliminary data on the present levels of petroleum and hydrocarbon contamination in the coastal waters of Kuwait. The oyster, Pinctada margaratifera, was used as an indicator species. Because of the high density of tanker traffic in the Arabian Gulf, the local marine environment is exposed to high chronic levels of oil pollution. The oysters were obtained at depths of 4 to 10 m at six sites in September and October of 1978. Levels of petroleum-derived hydrocarbons were highest at a sampling site near a major oil loading facility. The effects of dispersants used to treat minor oil spills could not be determined. Levels of total petroleum-type hydrocarbons in oysters at this site were equivalent to those in mussels from harbors, bays, and the urban coastal areas of California. Levels of DDE and PCB in Kuwait oysters were comparable to levels found in relatively unpolluted areas of North America. (Small-FRC)
W81-03496

INFLUENCE OF REPRODUCTIVE ACTIVITY ON TOXICITY OF PETROLEUM HYDROCARBONS TO GHOST CRABS,

South Carolina Univ., Columbia.
L. Jackson, T. Bidleman, and W. Vernberg.

Marine Pollution Bulletin, Vol 12, No 2, p 63-65, February, 1981. 2 Tab, 23 Ref.

Descriptors: *Crabs, *Crude oil, *Toxicity, Laboratory equipment, Sublethal effects, Gills, Petroleum hydrocarbons.

The importance of reproductive state relative to the toxicity of a water-soluble fraction of Kuwait crude oil to ghost crabs, Ocypode quadrata, was investigated. Sexually mature crabs were collected at Pawley's Island, South Carolina, and exposed in the laboratory to solutions of seawater and Kuwait crude oil. Reproductively active individuals were more susceptible to low concentrations of oil than were those individuals not reproductively active. Oil did not appear to have entered any tissues apart from the gills, nor was the uptake in active animals any higher than the uptake in non-reproductively active animals. An aromatic ratio was developed in an attempt to provide a measure of the differential accumulation of WSF aromatic compounds. A change in this ratio would reflect differential accumulation of aromatic compounds. The aromatic ratio for Kuwait crude is 0.558, while that for the initial WSF actually dropped considerably throughout the course of the experiment, presumably as a consequence of the gradual volatilization of the lighter aromatic compounds. (Small-FRC)
W81-03499

ACCLIMATION TO LEAD IN THE FRESHWATER ISOPOD ASELLUS AQUATICUS,

Preston Polytechnic (England). Biology Div.
J. Fraser.

Oecologia, Vol 45, No 3, p 419-420, June, 1980. 2 Tab, 13 Ref.

Descriptors: *Lead, *Isopods, *Resistance, Water pollution effects, Asellus aquaticus, Metals, Heavy metals, Aquatic animals, Crustaceans, Invertebrates.

Lead tolerant and non-tolerant populations of the freshwater isopod Asellus aquaticus were exposed to 5 concentrations of lead, 100 to 800 mg per liter, with and without 5 days pretreatment with 0.1 mg Pb per liter. In larger animals, 7-10 mm, mortality rates were as follows: non-tolerant, without pretreatment, 87%; non-tolerant, with pretreatment, 61%; tolerant, without pretreatment, 48%; and tolerant, with pretreatment, 74%. Smaller animals, 4-6 mm, were generally more susceptible. Mortality rates were as follows: non-tolerant, without pretreatment, 96%; non-tolerant, with pretreatment, 81%; tolerant, without pretreatment, 74%; and tolerant, with pretreatment, 77%. Results suggest that tolerance is not genetic, but may be achieved by exposure at a juvenile stage. Larger tolerant animals pretreated with low levels of lead showed greater mortality upon further exposure. (Cassar-FRC)
W81-03510

CORRELATION OF ALKALINITY AND THE DISTRIBUTION OF POTAMOGETON IN NEW ENGLAND,

Boston State Coll., MA. Dept. of Biology.
C. B. Hellquist.

Rhodora, Vol 82, No 830, p 331-344, April, 1980. 3 Fig, 2 Tab, 20 Ref.

Descriptors: *Alkalinity, *Acidic water, *Pondweeds, Distribution patterns, Aquatic plants, Rivers, Water pollution effects, New England, Alkaline water, Aquatic weeds, Weeds, Water quality, Nutrients.

The ranges of the species of Potamogeton in New England were related to the chemical properties of the water in which they grow, specifically to alkalinity measured as bicarbonate. Sampling was done at 321 sites in rivers, ponds, and streams. Waters were classified into 6 groups by alkalinity and Potamogeton species. Group I was the acidic group; Groups II-IV, moderately alkaline; Group V, alkaline; and Group VI, very alkaline. Comparisons with a similar study showed that New England species generally tolerated lower alkalinities than their counterparts in Minnesota. (Cassar-FRC)
W81-03513

EFFECTS OF ELEVATED TEMPERATURE ON GROWTH AND SURVIVAL OF SMALLMOUTH BASS,

Tennessee Valley Authority, Decatur, AL. Biothermal Research Station.
W. B. Wrenn.

Transactions of the American Fisheries Society, Vol 109, No 6, p 617-625, November, 1980. 2 Fig, 4 Tab, 19 Ref.

Descriptors: *Bass, *Water temperature, *Growth, Fishing, Temperature, Fish, Climate, Survival, Thermal pollution, Powerplants, Ecological effects.

The primary objective of the study was to determine the annual effect of elevated temperature on the growth and survival of juvenile smallmouth bass at the southern limits of their native range. The study was also intended to promote further development of numerical temperature criteria for this species in accordance with procedures recommended by the Environmental Protection Agency. The fish grew substantially at temperatures both above and below the optimum range of 25-29C, but it was not possible to determine a single optimum level. At the highest treatment temperature, 70% of the annual growth occurred at temperatures outside this acceptable range. When the temperature criteria are being developed for this important commercial species, key temperatures must be considered for growth, survival and reproduction. The acceptable mean weekly average temperature (MWAT) for the growth was 32-33 degrees C, even though this species will tolerate elevated temperatures just as the largemouth bass can, even at the southern limits of the native range. (Baker-FRC)
W81-03516

THE HISTORY OF TWO LINKED BUT CONTRASTING LAKES IN NORTH WALES FROM A STUDY OF POLLEN, DIATOMS, AND CHEMISTRY IN SEDIMENT CORES,

University Coll. of North Wales, Bangor. School of Plant Biology.
J. K. Elner, and C. M. Happey-Wood.

Journal of Ecology, Vol 68, No 1, p 95-121, March, 1980. 20 Fig, 1 Tab, 38 Ref.

Descriptors: *Lakes, *Sedimentology, *Copper, Mining, *Wales, Eutrophication, Water pollution effects, Diatoms, Algae, Aquatic algae, Chrysophyta, Bioindicators, Pollen.

Two lakes in northern Wales, linked by a small river, but differing in trophic state, were studied using long sediment cores. The upper lake, Llyn Peris, is oligotrophic; the lower lake, Llyn Padarn, is more eutrophic, with a rate of primary production 5 times greater. The sediment cores, analyzed by magnetic susceptibility, pigment analysis, Pb210 dating, pollen profiles, radiocarbon and geomagnetic dating, diatom profiles, and chemical profiles, revealed a 6,000 year history in Padarn and a 900 year history in Peris. The principal changes in the diatom communities in Llyn Padarn are probably the result of vegetational changes. During the Pinus forest stage, Melosira were dominant; deciduous forest stage, Cyclotella; deforestation stage, Asterionella; and heath and grassland stage, Cyclotella. Llyn Peris was similar to Llyn Padarn until copper and slate mining was introduced into the area. At that time the Cyclotella community changed to Rhizosolenia. When mining activities stopped, Chrysophyceae became dominant and have remained so. Chemical profiles reflect the copper input into the sediment. (Cassar-FRC)
W81-03517

THE QUANTITATIVE IMPACT OF PH, BIOPRODUCTION, AND HG-CONTAMINATION ON THE HG-CONTENT OF FISH (PIKE),

National Swedish Environmental Protection Board, Uppsala (Sweden). Limnological Survey.
L. Hakanson.

Environmental Pollution (Series B), Vol 1, No 4, p 285-304, 1980. 6 Fig, 9 Tab, 35 Ref.

Descriptors: *Mercury, *Fish, *Pike, Trophic level, Hydrogen ion concentration, Mathematical studies, Methyl mercury, Equations, Lakes, *Sweden, Sediment, Water pollution, Productivity, Nutrients, Limnology, Planning, Forecasting, Water pollution control.

An equation was developed and tested to predict the content of methyl mercury in a 1 kg pike using three variables: mercury content of the surface sediment, pH of the water system, and bioproduction index. Higher methylmercury levels were found in fish from waters with low productivity, low pH, and high water and sediment Hg load. Comparison with observed results indicated that all three factors must be considered to obtain a reliable estimate of methylmercury in fish. The equation was used to explain the fact that fish in lakes receiving no Hg-contaminated waste water may nevertheless have high methylmercury levels if the lakes are acid and poor in productivity. Cleaning up a lake by reducing sewage input was shown to increase methylmercury content of fish because bioproductivity is decreased and pH lowered. (Cassar-FRC)
W81-03519

TEMPERATURE STRUCTURE AND WATER CHEMISTRY OF THE CALDERA LAKE OSKJUVATN, ICELAND,

Marine Research Inst. Reykjavik (Iceland).
J. Olafsson.

Limnology and Oceanography, Vol 25, No 5, p 779-788, September, 1980. 2 Fig, 5 Tab, 36 Ref.

Descriptors: *Water pollution effects, *Lakes, *Oligotrophy, *Water temperature, *Lake Oskjuvatn, Dissolved solids, Volcanoes, Aquatic life, Phytoplankton, Algae, Diatoms, Protozoa, *Iceland, Trace metals, Hydrogen ion concentration, Limnology, Dissolved oxygen, Nutrients, Thermal properties, Water pollution sources.

Lake Oskjuvatn, Iceland, created in 1875 by volcanic eruption and the scene of subsequent eruptions in 1921 to 1926, showed a phytoplankton count of only 0.01 mg per liter at the summer maximum. Dominant were the diatom, Melosira islandica, and chlorophyta with a few chrysomonads. Only a few individual protozoans constituted the zooplankton. As a result of the volcanic emanations, dissolved solids concentration was high, 984

mg per liter, but evenly distributed in this oligotrophic lake. Results were (in mg per liter): bicarbonate, 144 + or - 3; chloride, 22.3 + or - 0.8; sulfate, 450 + or - 4; fluoride, 0.90 + or - 0.04; sodium, 145 + or - 2; potassium, 8.6 + or - 0.2; calcium, 80.0 + or - 1.2; magnesium, 23.6 + or - 4; silicate, 110 + or - 3; and lithium 0.04. Trace metal concentrations were measured at the surface and at 18 meters depth in micrograms per liter: Fe, 1,750 and 4,400; Mn, 114 and 204; Zn, 4.3 and 4.7, and Cu, 3.5 and 7.9. The pH varied from 7.3 at the surface to 6.7 at 80 meters depth; oxygen saturation varied from 86 - 94% at the surface to about 45% near the bottom. Nutrients were quite variable in the marginal springs, but evenly distributed in the lake. Phosphate-phosphorus was 1.2 microgram-atoms per liter and nitrate-nitrogen, 0.3 microgram-atoms per liter. At one sampling station, water temperature varied from 6.35C on the surface to 3.83 at 200 meters depth. At another station 10.2C was measured on the bottom, indicative of thermal activity. (Cassar-FRC)
W81-03521

THE INVESTIGATION OF OIL INDUSTRY INFLUENCES ON TROPICAL MARINE ECOSYSTEMS,
Field Studies Council, Pembroke (England). Orielton Field Centre.
J. M. Baker.
Marine Pollution Bulletin, Vol 12, No 1, p 6-10, January, 1981. 2 Fig, 8 Ref.

Descriptors: *Oil spills, *Environmental effects, *Tropical regions, Oil pollution, Nigeria, Indonesia, Ecology, Marine animals, Marine plants, Mangrove swamps, Water pollution effects.

Although much information has been published on the effects of oil pollution in temperate zones, little of this knowledge can be applied to the tropical zones. The basic biology of tropical marine ecosystems is not well known, and reliable statistics on the economic importance of the shallow tropical seas and mangrove swamps are probably underestimated. Considerable physical hardships are encountered by investigators during studies in remote, hot areas. An on-site survey was done, primarily by Indonesian and U.K. organizations and scientists after the Showa Maru spill off Indonesia, January 6, 1975. Sediment and water samples showed little petroleum hydrocarbon contamination, but many mangroves and associated fauna were dead or contaminated, especially in sheltered bays. Some preliminary ecological studies were also begun after a Nigerian well blew on January 27, 1980. Further study of the impact of oil pollution in tropical regions is needed to prepare for oil exploration in these parts of the world. (Cassar-FRC)
W81-03523

EFFECTS OF DECREASED PH ON MARINE ORGANISMS,
Norsk Inst. for Vannforskning, Oslo.
J. Knutzen.
Marine Pollution Bulletin, Vol 12, No 1, p 25-29, January, 1981. 1 Fig, 1 Tab, 43 Ref.

Descriptors: *Hydrogen ion concentration, *Marine animals, *Marine algae, Algae, *Acidic water, Water pollution effects, Chemical reactions, Toxicity, Calcification, Shells.

A review of the literature on effects of pH on marine life concluded that pH in open seawater should not deviate more than + or - 0.1-0.2 units from normal (7.8-8.2, rarely below 7.6). Although there is little evidence that a decrease of 0.5-1.0 units is harmful, few long term or life cycle studies are on record. pH decreases may result from industrial discharge, particularly from scrubbing flue gases in coal-fired plants. Further research is necessary on many aspects. Lowered pH can influence sea water chemistry (equilibrium between complex and simple metal ions, change of amphoteric substances, solubility, and carbonic acid equilibrium). Little data is available on chronic toxicity and life cycle bioassay, differences in species tolerance, shell calcification or dissolution of marine animals and algae, and synergistic effect upon toxic substances. (Cassar-FRC)
W81-03525

HEAVY METALS, ORGANOCHLORINE PESTICIDES AND PCB'S IN GREEN MUSSELS, MULLETS, AND SEDIMENTS OF RIVER MOUTHS IN THAILAND,
Chulalongkorn Univ., Bangkok (Thailand). Dept. of Marine Science.
For primary bibliographic entry see Field 5A.
W81-03526

EFFECTS OF PENTACHLOROPHENOL ON FIELD- AND LABORATORY-DEVELOPED ESTUARINE BENTHIC COMMUNITIES,
Environmental Research Lab., Gulf Breeze, FL.
M. E. Tagatz, J. M. Ivey, N. R. Gregory, and J. L. Oglesby.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 1, p 137-143, 1981. 4 Tab, 5 Ref.

Descriptors: *Benthic fauna, PCP, *Water pollution effects, Population exposure, Animal populations, *Pentachlorophenol, Chlorinated hydrocarbons, Mollusks, Annelids, Aquatic animals, Estuarine environment, *Environmental effects.

The effects of pentachlorophenol (PCP) on estuarine benthic communities of natural and laboratory origin were examined in 1-week exposure tests. After the test period, animals were collected with a 1 mm-mesh sieve and identified. Levels of PCP in water from tanks containing field-developed benthic communities ranged from non-detectable to 141 micrograms/liter, and in tanks containing laboratory-developed communities, from 1.1 to 140 micrograms/liter. Field grown benthic communities yielded 346 animals representing 6 phyla and 32 species, while laboratory-raised communities yielded 800 animals representing 5 phyla and 24 species. A two-way analysis of variance revealed some differences in the effect of PCP concentration between field and laboratory communities. Community structure was significantly altered by 141 micrograms PCP/liter (field) and 140 micrograms/liter (laboratory). Mollusks exposed to the highest levels of PCP were significantly affected in communities developed in the field. Effects of PCP on annelids were species dependent. No significant differences were noted in arthropod and chordate populations of PCP-exposed and control benthic communities of either field or laboratory origin. (Geiger-FRC)
W81-03567

EFFECTS OF ROUNDUP HERBICIDE ON DIATOM POPULATIONS IN THE AQUATIC ENVIRONMENT OF A COASTAL FOREST,
Northwest Ecological Animal Research Ltd., Vancouver (British Columbia).
D. S. Sullivan, T. P. Sullivan, and T. Bisalputra.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 1, p 91-96, 1981. 3 Fig, 17 Ref.

Descriptors: *Diatoms, *Herbicides, *Water pollution effects, Algae, Aquatic populations, Pesticides, Glyphosate, Environmental effects, Coniferous forests, Phytoplankton, Streams, Coastal forest.

The postemergence herbicide, Roundup (glyphosate), was applied aerially and manually to small streams running through a coastal Douglas fir plantation in British Columbia to determine the effects of the compound on aquatic diatom populations. The herbicide was applied aerially at a rate of 2.2 kg a.i./ha, and slide and sediment samples were taken to identify and count diatom populations. In a second experiment, Roundup was applied manually to a stream at a field dose of 2.2 kg/ha and at ten times this dose further downstream. Slide samples from the manually sprayed stream were collected and examined as in the first experiment. Sediment samples from the aerially sprayed area generally contained a greater density of diatoms than those from the control area. Colonization of slides by diatoms in both the aerially-sprayed and manually-sprayed areas was extremely low; however, this was attributed to environmental differences rather than to effects of herbicide treatment. While laboratory studies may be used to determine the effects of pesticides on unicultures of algae, field studies are recommended to take into account synergistic and interspecific responses that may occur in the environment. (Geiger-FRC)
W81-03568

INFLUENCE OF CHROMIUM(VI) UPON STREAM EPHEMEROPTERA IN THE PRE-ALPS,
Milan Univ. (Italy). Ist. di Zoologia.
M. C. Ramusino, G. Pacchetti, and A. Lucchese.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 2, p 228-232, 1981. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Chromium, *Stream biota, *Toxicity, Streams, Alpine regions, Insects, Mountains, Benthos, Metal-finishing wastes, Industrial wastes, Heavy metals, Aquatic life.

Variations in Ephemeroptera larvae populations were studied in a typical pre-alpine watercourse, the Grua Stream. This stream arises from Mount Zaccaro 850 m above sea level and flows into the Agogna near Borgomanero, 308 m above sea level. Tributaries enter the stream 4 km downstream from its source, carrying with them pollutants from industrial areas where metals are galvanized. The presence of Cr (VI) caused several changes in the Ephemeroptera larvae populations. It was concluded that the Ephemeroptera larvae are good indicators of the deep crises affecting benthos in the Grua Stream. E. torrentium and Rhithrogena semicolorata were hardly found in the Cr polluted areas at all, whereas they were found in the non-polluted parts of the stream. Ecdyonurus helveticus, Habrophlebia umbratilis, Baetis rhodani and Baetis gemellus were apparently not affected. (Baker-FRC)
W81-03570

VERTICAL RESPONSES OF ATLANTIC CROAKER TO GAS SUPERSATURATION AND TEMPERATURE CHANGE,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
G. W. Chamberlain, W. H. Neill, P. A. Romanowsky, and K. Strawn.
Transactions of the American Fisheries Society, Vol 109, No 6, p 737-750, November, 1980. 10 Fig, 1 Tab, 31 Ref.

Descriptors: *Supersaturation, *Temperature effects, *Fish behavior, Nitrogen, Oxygen, Fish physiology, Dissolved oxygen, Statistical models.

The initial vertical responses of Atlantic croaker to various conditions of gas saturation and temperature change were evaluated. The relative responses of the fish to nitrogen, oxygen, and air supersaturation were investigated. The effects of temperature were explored both singly and in combination with supersaturation. Many of the responses observed in the croaker to gas supersaturation matched the responses described by other researchers who have studied the effects of swim-bladder volume manipulation in other fish. This suggests that gas supersaturation may influence swim-bladder volume. Models were used to statistically relate changes in vertical distribution of the fish to linear combinations of the measured experimental variables. The most successful model suggested that the vertical displacement of the fish was linearly related to the square of ambient temperature, concentration of dissolved oxygen, and average rate of change in oxygen's percent saturation during the interval preceding the observation. (Small-FRC)
W81-03573

NITROGEN AND PHOSPHORUS IN THE SEDIMENTS OF LAKE ROTORUA,
Marine Dept., Rotorua (New Zealand). Fisheries Research Div.
G. R. Fish, and I. A. Andrew.
New Zealand Journal of Marine and Freshwater Research, Vol 14, No 2, p 121-128, 1980. 6 Tab, 30 Ref.

Descriptors: *Phosphorus, *Nitrogen, *Bottom sediments, *Lake sediments, Sediment-water interfaces, Eutrophic lakes, Eutrophication, Water pollution effects, *New Zealand, Lake Rotorua.

The distribution of nitrogen and phosphorus within sediment cores retrieved from Lake Rotorua (New Zealand) during 1976-79 was determined. Measurements were made at approximately 1 cm depth intervals in 10 short sediment cores. Concentrations were high at the surface and fell to more constant values about 20 cm below the surface. The season of retrieval or the location of the sampling site did not influence the measurements. An estimate of the material dissolved in the interstitial water was obtained by analyzing the liquid fraction of diluted sediment samples after the solids had been separated by centrifugation. Soluble salts did not seem to be lost to the lake water. Samples of sediments from Lake Rotoiti and from below the layer of Rotomahana Mud in Lake Rotorua had consistently lower concentrations. These lake areas are less eutrophic than Rotorua, in general. Only an insignificant proportion of the nitrogen and phosphorus present in the sediments seemed to be lost to the overlying lake water when it was oxygen depleted during summer stratification. (Small-FRC)
W81-03575

NEARSHORE DREDGE-SPOIL DUMPING AND CADMIUM, COPPER, AND ZINC LEVELS IN A DERMESTID SHRIMP,
Hawaii Univ., Honolulu. Environmental Center.
W. N. Albrecht, C. A. Woodhouse, and J. N. Miller.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 2, p 219-223, 1981. 2 Tab, 8 Ref.

Descriptors: *Shrimp, *Heavy metals, *Dredging, Spoil banks, Crustaceans, Aquatic life, Cadmium, Copper, Zinc, Accumulation, Sediments, Estuaries.

Cadmium, copper, and zinc residue levels were evaluated in a control-site population and a dredge spoil dumping-site population over a period of two years' active dumping to determine any modification in the bioaccumulation of these metals in the dermestid shrimp. The results indicated that the amount of total metals recovered did not yield much insight into any dynamic ecological processes which may have been altered by the dredge spoil dumping. In the animals examined in the second year at both the control site and the dumpsite, there was a noticeable redistribution of metals, with cadmium displacing copper in the tissues. The zinc content as a percentage of the total remained constant over the two year period. Since there was no apparent variation in the distribution of cadmium, zinc, or copper in either the control or the dumpsite groups it can be concluded that shrimp in the dumpsite area did not excessively accumulate these metals. Dredge spoil dumping may have had an effect on the relative distribution of metals within the shrimp, with cadmium substituting for copper, but, on the other hand, the analyses may have detected a trend quite independent of dredge spoil disposal in the area. (Baker-FRC)
W81-03587

TOXICITY OF OZONATED ESTUARINE WATER TO JUVENILE BLUE CRABS (CALLINECTES SAPIDUS) AND JUVENILE ATLANTIC MENHADEN (BREVOORTIA TYRANNUS),
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Lab.
L. B. Richardson, and D. T. Burton.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 2, p 171-178, 1981. 2 Fig, 2 Tab, 21 Ref.

Descriptors: *Ozonation, *Aquatic life, *Estuaries, Saline water, Crabs, Crustaceans, Menhaden, Fish, Powerplants, Ozone, Toxicity.

This study was initated to provide baseline information on the toxicity of ozonated estuarine water to two representative species the blue grass carb, Callinectes sapidus Rathbun, and the Atlantic menhaden, Brevoortia tyrannus Latrobe. Crabs were continuously exposed to ozone-producing oxidants at concentrations of 0.113 to 0.674 mg/liter for 144 hr. Atlantic menhaden were exposed at concentrations from 0.79 to 0.324 mg/liter for 96 hr. The modeling equation constructed from the results of the experimentation indicates that ozone-producing oxidant concentration and the natural logarithm of time are the only significant independent variables for predicting the mortality of the crab species during continuous exposure to ozone-producing oxidants. Mortality increased logarithmically parallel to the exposure time axis and in the flattened sigmoid fashion characteristic of the arcsine function along the concentration axis. However, concentration was the more important of the two variables. For the Atlantic menhaden, however, mortality was significantly affected by the dose concentration terms. (Baker-FRC)
W81-03589

5D. Waste Treatment Processes

WASTE WATER TREATMENT METHOD USING ACTIVATED CARBON,
Asahi Kasei Kogyo Kabushiki Kaisha, Osaka (Japan).
Y. Tagashira, H. Takagi, and K. Inagaki.
U.S. Patent No 4,203,835, 10 p, 3 Fig, 5 Tab, 6 Ref; Official Gazette of the United States Patent Office, Vol 994, No 3, p 984, May 20, 1980.

Descriptors: *Patents, *Waste water treatment, Water pollution treatment, *Separation techniques, Industrial wastes, *Activated carbon, Adsorption, Copper, Ammonia, Regeneration, Wet oxidation.

A method for effectively treating waste water discharged from the ammoxidation process for the production of acrylonitrile comprises treating the waste water or a preliminary oxidized liquid of waste water with activated carbon in an adsorption and separation zone. The spent carbon slurry from the adsorption and separation is subjected to wet oxidation in the presence of copper values and ammonium ions at a pH of not higher than 5 in a regeneration zone to regenerate the spent carbon. The regenerated activated carbon is recycled to the absorption and separation zone. The rate of regeneration of the spent carbon can be further increased by adjusting the amount of copper values to at least 1,000 ppm. Thus the waste water can be effectively treated and, at the same time, the spent carbon can be regenerated with less degradation of adsorption capacity. (Sinha-OEIS)
W81-03280

ON-SITE WASTEWATER TREATMENT AND DISPOSAL SYSTEMS (ENVIRONMENTAL AND HEALTH EFFECTS),
Patterson Associates, Inc., Chicago, IL.
C. L. Schmidt, and J. W. Patterson.
Illinois Institute of Natural Resources, Chicago. Document No 80/19, December, 1980. 229 p, 27 Fig, 27 Tab, 102 Ref.

Descriptors: *Illinois, *Septic tanks, Sewerage, Septic sludge, *Septic wastewater, *Aerobic treatment, Sewer systems, Electro-osmosis, *Wastewater treatment, Wastewater facilities, Effluent seepage, Soil absorption capacity, Soil mechanics, Soil properties, *Wastewater disposal.

In five regional studies, water resource professionals in 35 states reported that a major source of groundwater pollution was septic tanks and cesspools. According to the 1970 U.S. Census, 15% of the housing units in Illinois were serviced by septic tanks, while 1.76% used a method of wastewater treatment other than septic tanks or disposal to public sewers. This report identifies and describes conventional and alternative on-site wastewater treatment and disposal systems, and discusses the economic, environmental and health aspects of pre-treatment and final treatment systems. A sampling of the report's conclusions and recommendations includes: (1) When soils are suitable, the septic tank in conjunction with a soil absorption field can be an excellent and economical alternative to on-site wastewater management. Use of sand filters or mound systems are recommended where poor soil conditions exist. (2) Surface, groundwater, and shallow well pollutants from failed septic systems include intestinal pathogens, inorganic and organic constituents of domestic sewage, and industrial contaminants. Failure of systems is an ongoing problem in the state. (3) Soil permeability is the single most important element in the design of a soil absorption field. (4) Local agencies should provide educational materials to owners and constructors of private sewage systems. (5) Inspection of these systems should be more rigorous. (6) Alternative systems should be installed and field tested. (Garrison-Omniplan)
W81-03291

ROCK FILTERS FROM REMOVAL OF ALGAE FROM LAGOON EFFLUENTS,
Oregon State Univ., Corvallis.
G. R. Swanson, and K. J. Williamson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-190077, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report, EPA-600/2-80-038, March, 1980. 89 p, 21 Fig, 10 Tab, 28 Ref, 2 Append.

Descriptors: *Filters, *Filtration, *Algal control, *Municipal wastes, *Wastewater lagoons, *Wastewater treatment, Sedimentation, Settling velocity, Mathematical models, Pilot studies, Decomposition, Clogging, Flow characteristics, Rock filters.

The objective of this project was to show that rock filtration was an effective, low cost unit process for removing algae from lagoon effluents and correspondingly upgrading lagoon treatment. Sedimentation is the primary mechanism of algal removal within rock filter. The settling rates of three species of algae common to lagoons were measured as varying from 0.02 to 0.3 m/day, depending on species and temperature. Settling rates of algae from the Veneta, Oregon municipal waste treatment lagoon were about 0.05 m/day. A mathematical model of the sedimentation mechanism was constructed based on discrete settling theory. A linear relationship between total suspended solids (TSS) removal efficiency and hydraulic loading rate was demonstrated. A full-scale horizontal flow operating rock filter designed for a maximum hydraulic loading of 0.28 cu m/cu m/day (1.6 days detention time) located at Veneta, Oregon was evaluated. Weekly average 5-day BOD and TSS did not exceed 20 mg/l. With improved flow characteristics a pilot scale rock filter achieved similar results for a short period of testing at twice the hydraulic flow. During the one year of testing on the full-scale rock filter, the rate of decomposition of the sediment accumulating in the filter appeared to be low due to the limited DO available. Clogging, however, does not seem to be a major problem since sufficient void volume is available to store settled matter for a minimum of 20 years. W81-03327

EVALUATION OF REVERSE OSMOSIS MEMBRANES FOR TREATMENT OF ELECTROPLATING RINSEWATER,
Abcor, Inc., Wilmington, MA. Walden Div.
K. J. McNulty, and P. R. Hoover.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-202385, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report, EPA-600/2-80-084, May, 1980. 51 p, 2 Fig, 14 Tab, 6 Ref, Append. R804311.

Descriptors: *Reverse osmosis, *Wastewater treatment, *Metal-finishing wastes, *Waste recovery, Recycling, Wastewater renovation, Industrial wastes, Hydrogen ion concentration, Wash water, Copper compounds, Cyanide, Zinc compounds, Inorganic acids, Electroplating.

Because of the limited pH range in which current commercially available reverse osmosis membranes can be applied, a test program was initiated to define the applicability of new membrane materials to the separation of dissolved plating chemicals from rinsewaters with extreme pH levels and high

oxidant levels. Life tests were conducted with the PA-300, PBIL, NS-100, NS-200, SPPO, B-9, and CA membranes on rinsewater from copper cyanide, zinc cyanide, acid copper and chromic acid plating baths. The PA-300 membrane exhibited superior performance for the treatment of copper cyanide, zinc cyanide, and chromic acid rinsewaters, and further development and demonstration of this membrane is recommended. The NS-200 and PBIL membranes exhibited the best performance for treatment of acid copper rinsewater. Additional testing and development is required before the promising membranes identified during this program can be offered to electroplaters as a viable means of achieving closed-loop recovery rinsewaters. Of these three membranes, PA-300 is the closest to commercialization. (Moore-SRC)
W81-03328

IMPROVEMENTS NEEDED IN ULTRAFILTRATION TO INCREASE THE RECYCLE OF WATER,
B. S. Horton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-212342, Price codes: A08 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, December, 1980. 162 p, 13 Fig, 13 Tab. OWRT-C-80002-S(No 8535)(1), 14-34-0001-8535.

Descriptors: *Ultrafiltration, *Water reuse, *Membranes, *Membrane processes, *Semipermeable membranes, Dairy industry, Metal-finishing wastes, Food-processing wastes, Pulp and paper industry, Pulp wastes, Food industry, Chemical industry, Chemical wastes, Oily water, Oil wastes, Wastewater, *Wastewater treatment, Separation techniques.

The primary objectives of this study were to identify the shortcomings in ultrafiltration (UF) which limit its use in water recycle applications and to recommend programs which OWRT might support to overcome those shortcomings. A secondary objective was to assess volumes of water already recycled because of UF and volumes which might be recycled in the future if the identified improvements were made. Existing and emerging applications were reviewed, as was the state-of-the-art of membrane materials, elements, systems, etc. The most important and complicated shortcoming was the inability to attain clean water flux rates under acutal operating conditions due to 'fouling' of the membrane. Other problems included lack of choice of membranes with certain pore characteristics, lack of optimization of certain membrane configurations, and high unit costs of the open channel (tubular) configuration. Recommended development programs were aimed at defining and overcoming fouling, at improvements in physical properties of membranes, and at reducing costs of tubular and flat plate products. It was estimated that 5 to 6 million gallons per day of permeate water are now recycled in the U.S.A. In 1985 this might reach 25 million gallons per day. In 2000, if all needed improvements are made and sewage treatment becomes a major application, a level of 100 million gallons of permeate water per day might be reached or exceeded.
W81-03334

LAND TREATING TANNERY SLUDGES, INITIATION OF A FIVE YEAR INVESTIGATION,
Tanners' Council of America, Cincinnati, OH.
R. M. Lollar.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 246-249. 1 Tab, 1 Ref.

Descriptors: *Land disposal, *Tannery wastes, *Chromium, *Wastewater treatment, Environmental effects, Heavy metals, Nitrogen compounds, Industrial wastes, Leachates, Soil properties, Monitoring.

The main objective of this investigation is the characterization of the technical and the environmental aspects of the utilization of land treatment technology for treating tannery sludges. This five year project will assess the environmental impact of the application of two tannery wastewater sludges when applied to soil plots. The two sludges are the proteinaceous/lime rich unhairing (beamhouse) sludges and the trivalent-chromium containing sludges from the other portions of a full chrome-tanned cattlehide tannery. The two sludges, and a mixture thereof, and an enhanced chromium-containing waste will be added to appropriate test plots annually at the end of each dry season. The grass grown on the test plots, the soil, the ground water and any leachate will be examined by analysis for various parameters but especially considering chromium partition. The site will be maintained under regular surveillance during the five-year period. The data will be assessed and appropriate site closure procedures will be developed. An overall goal is the development of data relevant to Best Engineering Judgement documents for land treatment facilities for tanning industry wastewater sludges. A site has been leased in Santa Cruz County, California; its soil characteristics, geology and hydrology have been evaluated. A site plan for the specific location of the eight 0.2 hectare experimental plots has been developed, and run-off control facilities designed. These eight test plots, equipped with wells and other devices necessary to monitor them, are being installed and will be given their initial sludge loading followed by grass seeding in December, 1980. (Brambley-SRC)
W81-03354

INORGANIC HAZARDOUS WASTE TREATMENT. II,
Little (Arthur D.), Inc., Cambridge, MA.
W. J. Lyman, and G. Contos.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 250-264. 9 Fig, 9 Tab, 4 Ref.

Descriptors: *Hazardous materials, *Heavy metals, *Leachates, *Metal-finishing wastes, *Municipal wastes, *Wastewater treatment, Chemical treatment, Filtration, Organic compounds, Separation techniques.

As part of an ongoing program to investigate selected processes for the treatment of inorganic hazardous wastes, methods have been selected for treating mixed acid wastes, landfill leachate, and a sludge containing heavy metals. The acid wastes are acid bath wastes with and without ammonia, from the electroplating and electrofinishing industries. Treatment consists of heavy metal precipitation using calcium hydroxide and sodium sulfide, adsorption of organics with powdered activated carbon, and periodic filtration to remove precipitates and the carbon. Very high heavy metal removal efficiencies are obtained, but waste volume remains large. The same treatment is used for the landfill leachates because of the heavy metals and organic compounds they contain. The treatment is efficient in removing heavy metals, and produces small volumes of solids. The sludge containing heavy metals is treated by a high gradient magnetic separation (HGMS) process. A study with a synthetic waste containing nickel hydroxide shows that the HGMS can remove the nickel, but it is not clear whether it is an economic process. (Brambley-SRC)
W81-03356

EMERGING TECHNOLOGIES FOR THE DESTRUCTION OF HAZARDOUS WASTE, ULTRAVIOLET/OZONE DESTRUCTION,
Ebon Research Systems, Washington, DC.
B. H. Edwards, J. N. Paullin, and K. Coghlan-Jordon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 265-271. 2 Tab, 11 Ref.

Descriptors: *Wastewater treatment, *Ozonation, *Ultraviolet radiation, *Hazardous materials, *Water pollution control, *Literature review, Oxidation process, Cost-benefit analysis, Dioxins, Hydrazine, Nitrobenzene, Polychlorinated biphenyls, Copper compounds, Industrial wastes, Waste disposal.

A literature search was conducted to obtain information on the use of ultraviolet/ozone destruction of hazardous wastes. Ultraviolet light provides energy to produce free radicals and enhances the oxidizing potential of ozone. The process has been demonstrated to be effective in the destruction of dioxins, hydrazine fuels, nitrobenzene, PCB's and a copper process waste stream. Consideration of the advantages and disadvantages of the process suggest that it is a viable emerging technology for the treatment of hazardous wastes when compared with the problems of landfills and conventional incineration. It is not cost-prohibitive from the standpoint of capital plus operating and maintenance costs. Since ozone is best used at its generation site, the ultraviolet/ozone process is particularly suitable for the on-site treatment of hazardous waste. (Brambley-SRC)
W81-03358

BENCH SCALE ASSESSMENT OF CONCENTRATION TECHNOLOGIES FOR HAZARDOUS AQUEOUS WASTE TREATMENT,
Touhill, Shuckrow and Associates, Inc., Pittsburgh, PA.
A. J. Shuckrow, and A. P. Pajak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 341-351. 4 Fig, 3 Tab, 3 Ref. 68-03-2766

Descriptors: *Groundwater pollution, *Remedies, *Wastewater treatment, *Organic compounds, Hazardous materials, Adsorption, Pollutants, Water pollution control, Chlorinated hydrocarbons, Aromatic compounds, Industrial wastes.

Studies on concentration technologies are being carried out at the Ott/Story site in Muskegon, Michigan using groundwater which has been severely contaminated by numerous organic compounds. There are over 70 organic pollutants at the site, the major ones being: vinyl chloride, methylene chloride, dichloroethylene, dichloroethanes, benzene, tetrachloroethane, and toluene. Specifically, bench scale laboratory treatability studies including activated carbon adsorption, resin adsorption, aerobic and anaerobic biological treatment, and stripping are under investigation. Most treatment technologies studied to date have been moderately effective in reducing the levels of organic contamination. However, a process train consisting of granular activated carbon adsorption followed by activated sludge treatment can achieve high levels of treatment for short periods of time. Virtually complete removal of organic priority pollutants can be achieved under some conditions, but high effluent TOC levels were found after all treatments, representing contamination by non-priority pollutants. (Brambley-SRC)
W81-03362

INFLUENCING PARAMETERS OF THE NITRIFICATION-DENITRIFICATION PERFORMANCE OF A SINGLE STAGE ACTIVATED SLUDGE PLANT,
Technische Hochschule, Vienna (Austria). Inst. fuer Wasserversorgung Abwasserreiningung und Gewasserschuts.
N. Matsche.
Progress in Water Technology, Vol 12, No 5, p 551-563, 1980. 3 Fig, 5 Tab, 5 Ref.

Descriptors: *Nitrogen removal, *Activated sludge, *Denitrification, Treatment facilities, Suspended solids, Microorganisms, Aeration, Nitrification, Temperature, Oxygen, Performance, Austria, *Waste water treatment, *Vienna.

Nitrogen removal was determined for a large scale single stage activated sludge plant, Vienna Blumental (Austria). The influence of the food-microorganisms ratio, mixed liquor suspended solids, aeration time, energy for aeration, and temperature were examined. Higher mixed liquor suspended solids were advantageous for denitrification. There was 60% reduction of total nitrogen at a food-microorganism ratio of 0.29 kg/kg day and a mixed liquor suspended solids of 3 kg/cu m, and a 72% reduction with a food-microorganism ratio of 0.25 kg/kg day and a mixed liquor suspended solids of 6 kg/cu m. Operation with only one aeration tank did not affect nitrification for a three week summer period. A longer period in winter with one tank did result in a loss in nitrification. A reduction in oxygen supply caused an increase in the NH4-N of the effluent. For optimal performance, the oxygen supply must be adapted to the oxygen uptake. (Small-FRC)
W81-03368

BIOTREATMENT USING CARBON TREATED RECYCLE AND/OR CLARIFIER EFFLUENT BACKWASH,
Phillips Petroleum Co., Bartlesville, OK. (Assignee).
W. C. McCarthy, and H. W. Goard.
U.S. Patent No 4,207,179, 11 p, 4 Fig, 5 Tab, 8 Ref; Official Gazette of the United States Patent Office, Vol 995, No 2, p 617, June 10, 1980.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Biological treatment, Activated carbon, Activated sludge, Recycling, Bacteria, Backwashing.

Industrial waste water is passed to a conventional biotreating zone and the resulting purified water is separated into at least two streams, a discharge stream and a recycle stream which is passed into contact with activated carbon and thence back into the biotreating zone as a dilution stream. With another embodiment, industrial waste water is passed to the biological treating zone of an activated sludge system and then to a clarifier zone, the effluent from the clarifier is passed to a filtration zone and periodically the filter is backwashed to return bacteria to the system. (Sinha-OEIS)
W81-03371

PROCESS FOR THE PURIFICATION OF INDUSTRIAL EFFLUENTS,
Ciba-Geigy Basel (Switzerland). (Assignee).
L. E. Kaiser, H. Scheidegger, and J. Haase.
U.S. Patent No 4,207,184, 8 p, 3 Ref; Official Gazette of the United States Patent Office, Vol 995, No 2, p 618, June 10, 1980.

Descriptors: *Patents, *Wastewater treatment, *Water pollution treatment, Industrial wastes, Water purification, Adsorption, Polymers.

A process for purifying industrial effluents is described where the effluents are brought into contact with a polymer adsorption material which is in the form of a solvated, preferably hydrated, gel. The treatment of the polluted liquid media with the polymer gels can optionally also be only part of a purification or recovery process. The preparation of drinking water and also certain effluent treatments can be effected over a number of steps in one of which the cited polymer gels can be used as adsorbent. After the adsorption of the impurities, the adsorption capacity of the polymer gels can be partially or completely recovered, for example by extraction with suitable solvents. (Sinha-OEIS)
W81-03372

METHOD FOR PURIFYING LIQUIDS,
Chevron Research Co., San Francisco, CA. (Assignee).
R. J. Hinds.
U.S. Patent No 4,207,185, 6 p, 1 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 995, No 2, p 618-619, June 10, 1980.

Descriptors: *Patents, *Water pollution treatment, *Oil pollution, *Separation techniques, Froth flotation, Frothing, Recycling, Gases.

The invention relates to an improvement in a method for separating a first liquid from a mixture of the first liquid and a particulate solid or a second liquid insoluble in the first liquid by treating the mixture in a series of flotation steps, including at least a first step and a last step, each of the steps including forming froth including the solid or the second liquid by mixing gas with the mixture and separating froth from the mixture. The improvement in the method comprises admixing the mixture, before separating froth from the mixture in the first step, with a recycle portion of the mixture remaining after froth is separated from the mixture in the first step and before gas is mixed with the mixture in the last step. (Sinha-OEIS)
W81-03373

METHOD OF PRODUCING ACTIVE FILTERS MORE PARTICULARLY FOR THE TREATMENT OF WATER AND WASTE WATER,
K. Haberer, H-U. Klen, and S. Normann.
U.S. Patent No 4,208,281, 4 p, 5 Ref; Official Gazette of the United States Patent Office, Vol 995, No 3, p 1002, June 17, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Filtration, Filters, Adsorption, Flow rates, Activated carbon, Regeneration, Plastic balls.

A method of producing active filters, particularly for use in treatment of water, is disclosed. A filter bed of buoyant plastic balls is provided. The balls have a surface to which a powdered active material capable of adsorbing dissolved impurities will adhere when subjected to liquid flow. A liquid containing the powdered active material is passed through the filter bed in the upward direction at a flow rate having the first value to cause the powdered active material to be distributed on and adhere to the surfaces of the plastic balls. The liquid to be purified is passed through the filter bed in the upward direction at a flow rate lower than the first value to cause impurities to be adsorbed by the powdered active material without removing the powdered active material from the surfaces of the plastic balls. The powdered active material is removed from the surface of the plastic balls after the filter has been used by passing a liquid through the filter bed in the downward direction at a flow rate having the second value. (Sinha-OEIS)
W81-03378

PROCESS FOR THE PURIFICATION OF SEWAGE WHILE RECAPTURING THE FATTY AND ALBUMINOUS MATTER IN REUSABLE FORM,
D. J. Becker.
U.S. Patent No 4,208,282, 4 p, 21 Ref; Official Gazette of the United States Patent Office, Vol 995, No 3, p 1002, June 17, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Sewage treatment, Separation techniques, Lipids, Flocculation, Flotation, Food processing industry, Product recovery.

The object of this invention is to provide a process in which fatty and albuminous matter may be separated practically and quantitatively from the sewage in a more simple and economically advantageous manner, and may be recovered in a directly re-usable form. A process is provided for the purification of sewage, especially of dairy wastes or wastes from meat or poultry processing plants, in which the fatty and albuminous matter is precipitated out by means of flocculation agents and subsequent expansion flotation. The mechanically prepurified sewage is adjusted to a pH value which lies near the average isoelectric point of the main protein mixture present. It is subsequently mixed with an aqueous solution of a substituted anionic starch while stirring continuously, and is then, after a short dwell time, subjected to an expansion flotation under a dispersion pressure of 4.5 to 6 bar. The flotation sludge thus obtained is separated, is drawn off and is sterilized by a single or repeated passages through an ultra violet sterilizing installation. The clarified sewage is diverted, by way of a series connected biological clarification stage, into the receiving water. (Sinha-OEIS)
W81-03379

PROCESS FOR TREATMENT OF WASTE WATERS,
Domtar, Inc., Montreal (Quebec). (Assignee).
R. J. Brouzes.
U.S. Patent No 4,208,283, 7 p, 1 Fig, 6 Tab, 8 Ref; Official Gazette of the United States Patent Office, Vol 995, No 3, p 1002, June 17, 1980.

Descriptors: *Patents, *Wastewater treatment, *Water pollution treatment, Industrial wastes, Domestic wastes, Microorganisms, Coliforms, Chlorination, Disinfection.

A process for treating aqueous industrial or municipal effluent is described. The effluent is treated with lime to a pH of at least 11.0, allowed to settle and the supernatant liquid treated with chlorine at the high pH. A substantially complete kill of micro-organisms, particularly coliforms, is thereby achieved. The liquid, after adjustment to suitable pH, may be returned to natural water streams. (Sinha-OEIS)
W81-03380

FILTERING APPARATUS,
De Hydro Corp., Fort Lauderdale, FL. (Assignee).
F. B. Stannard, and E. J. Highstreet.
U.S. Patent No 4,208,288, 8 p, 6 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 995, No 3, p 1004, June 17, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Filtration, Suspended solids, Separation techniques, Filters, Equipment.

Filter apparatus for removing fine solids from aqueous effluents, e.g., waste water filtration, comprises horizontal upper and lower rigid filter plates formed of aggregate fixed in a matrix of cured organic resin defining a secondary filter zone containing loose filter media. First and second fluid confining chambers are placed above and below the filter plates. In a filtering mode, the liquid suspension to be filtered flows into the first chamber via vertical conduit and then passes, in turn, through the upper filter plate, the filter zone, the lower filter plate and the second chamber to discharge. In a washing mode, wash water from the sparger cleans the filter cake from the upper filter plate forming a slurry that discharges from the apparatus via the vertical conduit. Wash water to clean the lower plate and the filter media is introduced into the second chamber to flow, in turn, through the lower filter plate, the filter zone and the uper filter plate to discharge via the vertical conduit. The new methods and apparatus remove solids with high efficiency while reducing ten fold or more wash water requirements as compared with prior art granular media filtration methods and apparatus. (Sinha-OEIS)
W81-03383

SIMPLE STATISTICS FOR INTERPRETING ENVIRONMENTAL DATA,
Wisconsin Univ., Madison.
P. M. Berthouex, and W. G. Hunter.
Journal of the Water Pollution Control Federation, Vol 53, No 2, p 167-175, February, 1981. 7 Fig, 1 Tab, 6 Ref.

Descriptors: *Graphical analysis, *Process control, *Data interpretation, Wastewater treatment, Monitoring, Wastewater facilities, Mathematical analysis, Mathematical studies, Graphical methods, Charts, *Water treatment facilities.

The frequency and severity of treatment plant upsets may be reduced if charts and tabulated data are rearranged to facilitate more rapid trouble-

shooting. A methodology is presented using waste water treatment plant data to show how simple graphs can be used to quickly detect upsets. It is very important that plots be kept current from monitoring process operations. They may also be saved for historical records. Information displayed in charts may be related to actual occurrences in the plant so that problems can be recognized by the operators. The use of the moving average and exponentially weighted moving average data is presented, and the methodology of the cumulative sum chart for biochemical oxygen demand is explained. Such charts have been successfully used by operators to detect malfunctions and propose changes that might alleviate further difficulties. (Geiger-FRC)
W81-03392

VARIATION IN NUTRIENT REMOVAL FROM A STREAM BY WATERCRESS (NASTURTIUM OFFICINALE R. BR.),
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
W. F. Vincent, and M. T. Downes.
Aquatic Botany, Vol 9, No 3, p 221-235, November, 1980. 9 Fig, 7 Tab, 20 Ref.

Descriptors: *Watercress, *Nutrient removal, *Water pollution treatment, Aquatic plants, Phosphates, Nitrates, Path of pollutants, Ammonium compounds, Streams, Diurnal, Seasonal, Root systems.

The large watercress population in a small stream leading into Lake Taupo, New Zealand, was believed responsible for large seasonal variations in removal of nitrates, phosphates, and ammonium compounds. The difference between upstream and downstream nutrient levels (measured monthly May 1973 to April 1974) reached a maximum in January and February (summer), the period of maximum cress biomass in the stream. In March 1975 (late summer) diel patterns were investigated. Nitrate levels were lowest at midday, maximum at midnight. Oxygen consumption studies showed similar variations, with a 4 hour lag. Phosphate and ammonium loss were relatively constant throughout the day. At midwinter, July 1979, nitrate differences upstream and downstream were almost insignificant; phosphate and ammonium increased downstream. Uptake of nitrate by watercress roots correlated with nitrate removal from the stream, with a 2-4 hour lag, over a 24 hour period. Phosphate was also removed, but did not demonstrate a diel pattern. Nitrate reductase levels were highest in leaves and lowest in roots. (Cassar-FRC)
W81-03420

METHOD AND APPARATUS FOR REMOVING PRECIPITATED SUSPENDED SOLIDS FROM AN EFFLUENT,
R. D. Hallack, and T. B. Carter.
U.S. Patent No 4,203,836, 9 p, 3 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 994, No 3, p 985, May 20, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Separation techniques, Metals, Suspended solids, Absorption, Equipment, Metal plating industry.

A method and apparatus is provided for separating suspended solids such as nickel, chromium, zinc, copper, iron, etc., from water containing such solids. The method comprises contacting the water with a liquid-absorbing medium. The liquid-absorbing medium selective absorbs the water to the substantial exclusion of absorbing the suspended solids. After some water is absorbed it is removed from the medium to refresh the medium and allow for the absorption of additional water. The apparatus comprises a solids-liquid separation unit which includes a perforated base having a dish-shaped upper portion. A liquid-absorbing medium is placed across the top of the base to form a seal over the perforations. A water receiving chamber is provided below the perforated base. A vacuum pump is provided for removing the water. A drying unit can also be provided to dry the liquid-absorbing medium so the solids can be removed from it. (Sinha-OEIS)
W81-03428

INFLUENCE OF CELL EFFICIENCY AND POPULATION OF OOCYSTIS SP. ALGA IN THE TERTIARY TREATMENT OF WASTEWATER (INCIDENCE DE L'EFFICACITE ET DE LA POPULATION CELLULARIES SUR LE TRAITEMENT TERTIAIRE DES EAUX USEES PAR L'ALGUE OOCYSTIS SP.),
Laval Univ., Quebec.
G. A. Picard, J. de la Noue, J. P. Piette, and C. Kirouac.
Archiv fur Hydrobiologie, Vol 90, No 1, p 75-89, September, 1980. 7 Fig, 30 Ref.

Descriptors: *Phytoplankton, *Tertiary treatment, Algae, Nutrients, Cyclostat, Waste treatment, *Waste water treatment.

A study was made of a two-phase wastewater treatment system. During the first phase, in a cyclostat, the phytoplankton cells are conditioned. During the second phase the wastewater is treated with conditioned cells. Some of the cyclostat parameters were investigated as a search was made for the optimum operating conditions. The amount of nitrogen input controlled the cell density at equilibrium, up to a maximum of about 325-400 micromoles N. The size of the cells increased with nitrogen input. Algal cells can be conditioned up to an input of 325 micromoles NH4-N. Nitrogen uptake during phase II was then at a maximum in response to the high concentration of nutrient-demanding algal cells. A turnover rate of 0.75/day in the cyclostat seemed to be nearly optimum. Through this study the limits of this system on a laboratory scale have been defined. (Baker-FRC)
W81-03439

SURFACE MASS TRANSFER PROCESSES DURING COLOUR REMOVAL FROM EFFLUENT USING SILICA,
Queen's Univ., Belfast (Northern Ireland). Dept. of Industrial Chemistry.
G. McKay, M. S. Otterburn, and A. G. Sweeney.
Water Research, Vol 15, No 3, p 327-331, March, 1981. 5 Fig, 2 Tab, 14 Ref.

Descriptors: *Dye industry wastes, *Adsorption, Silica, Kinetics, Model studies, Porosity, *Color removal.

The aim of the paper is to study the surface mass transfer processes which influence the initial uptake of dye onto silica during wastewater treatment. While the experimental results have been previously presented, no kinetic model was proposed. The influence of agitation, initial dye concentration, silica particle size and dye temperature on the dimensionless surface mass transfer term has been studied. These four variables were successfully correlated with the dimensionless mass transfer function on logarithmic coordinates, thus indicating that the proposed three-step mechanism for the adsorption of Astrazone Blue on silica is reasonably satisfactory. (Baker-FRC)
W81-03444

NUTRIENT REMOVAL AND RECOVERY FROM WASTEWATER BY ION EXCHANGE,
Istituto di Ricerca sulle Acque Bari (Italy).
L. Liberti, G. Boari, D. Petruzzelli, and R. Passino.
Water Research, Vol 15, No 3, p 337-342, March, 1981. 6 Fig, 2 Tab, 15 Ref.

Descriptors: *Tertiary wastewater treatment, *Municipal wastes, Filtration, Adsorption, Ammonium, Phosphates, Pilot plants, Ion exchange, Nutrients, Separation techniques, Evaluation, Economic aspects, *Nutrient removal.

A process evaluation was performed on a fully automatic laboratory pilot plant in continuous operation since March 1979 for the removal of ammonium from wastewaters using clinoptilolite. The process uses two ion exchange resins, cationic and anionic, in series, for treating a municipal secondary effluent and removing residual suspended solids by filtration, bioresistant organics by adsorption, and ammonium and phosphate ions by selective ion exchange. Neutral NaCl at sea-water concentration serves as a single resin regenerant. A valuable fertilizer and ammonium nitrate are recovered and can be reused. Following treatment of about 40,000 bed volumes of wastewater, the plant evaluations indicated that a triple purpose use of ion exchange (filtration, adsorption and selective removal of ammonium and phosphate ions) is feasible and provides effective tertiary treatment for municipal wastewaters. (Baker-FRC)
W81-03446

ACTIVATED SLUDGE RESPONSE TO EMULSIFIED LIPID LOADING,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
S. E. Hrudey.
Water Research, Vol 15, No 3, p 361-373, March, 1981. 11 Fig, 8 Tab, 53 Ref.

Descriptors: *Activated sludge, *Lipids, Sludge, Primary sludge, Primary wastewater treatment, Bacteria, *Wastewater treatment.

Possible effects of emulsified lipids on activated sludge process performance were investigated. A bench scale activated sludge experiment was carried out using both synthetic sewage and primary sewage. For moderate organic loadings effluent quality for lipid-dosed activated sludge plants was generally not significantly different from sucrose supplemented control plants, and was in some cases significantly better. Effluent quality parameters depended on unit lipid loading to a highly significant degree. Emulsified lipids exhibited no inhibitory effect on activated sludge specific soluble substrate removal rate over an experimental range of 0.04 to 0.78 g lipid/day/g mixed liquor suspended solids based on synthetic sewage studies. Emulsified lipids exhibited no inhibitory effect on mixed liquor oxygen consumption rates in primary sewage studies. This suggests that lipid overloading of activated sludge exerts an effect by some mechanism other than metabolic inhibition of heterotrophic bacteria. Lipid overloading can exhibit poor performance from the process in terms of general effluent quality without necessarily indicating poor removal of lipids. As lipid loading was raised beyond 0.25 g lipid/day/g mixed liquor suspended solids the activated sludge process exhibited poor effluent quality. (Baker-FRC)
W81-03448

PETROLEUM PROCESSING AND COAL CONVERSION WASTES,
Metcalf and Eddy, Inc., Boston, MA.
E. L. Stover, and N. K. Chung.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1429-1433, June, 1980. 32 Ref.

Descriptors: *Synthetic fuels, *Oil wastes, *Organic wastes, Fuels, Oil pollution, Oil industry, Oily water, Organic compounds, Coal, Industrial wastes, Water pollution, Wastewater treatment, Waste treatment, Reviews.

Recent literature on wastes from petroleum processing and coal conversion is reviewed from the aspects of regulation, characterization, treatment, disposal, and environmental effects. Available treatment and disposal methods for oil wastes include flotation, sand filtration, biological treatment, traps, oxidation ponds, flocculation, granular activated carbon, land application, and underground injection. The newer synthetic fuel industry can use some waste treatment methods applicable to the petroleum industry. However, these wastes are significantly different in chemical composition. Characterization and specific treatments are the objects of present and future work. (Cassar-FRC)
W81-03478

STEEL INDUSTRY WASTES,
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
D. T. Vachon, T. R. Bridle, and N. W. Schmidtke.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1445-1451, June, 1980. 83 Ref.

Descriptors: *Iron, *Steel, *Industrial wastes, *Coal, Chemical wastes, Wastes, Water pollution sources, Plating wastes, Oily water, *Wastewater treatment, Thermal pollution, Cyanides, Phenols, Ammonia, Runoff, Leachate, Literature review, Phosphorus compounds, Heavy metals, Water reuse.

The nature and treatment of wastes produced by the iron and steel industry are summarized in a review of recent publications. Several papers on process water requirements and recycling include costs and treatment methods. Runoff and leachate from coal and coke storage piles and process effluent streams are assessed as water pollution sources. Different processes in iron and steel manufacture produce both similar and unique pollutants as follows: coke production--oils, tar, phenolics, sulfide, cyanide, ammonia, and carcinogens; steel making--solids, oils, and heat; hot and cold rolling mills--iron fines, oil and grease; pickling and finishing operations--acids, phosphorus, iron oxide, heavy metal salts (Cr and Zn), fluoride, cyanide, thiocyanate. Treatment methods for many of these materials are described. (Cassar-FRC)
W81-03480

ELECTROPLATING AND CYANIDE WASTES,
Argonne National Lab., IL. Energy and Environmental Systems Div.
M. F. Torpy.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1451-1455, June, 1980. 3 Tab, 38 Ref.

Descriptors: *Metal-finishing wastes, Plating wastes, *Cyanide, *Electroplating industry, *Heavy metals, Industrial wastes, Regulations, Copper, Chromium, Lead, Zinc, Nickel, Silver, Cadmium, Wastewater treatment, Analytical techniques, Pollutant identification, Toxicity, Aquatic life, Fish, Reviews, Chemical wastes, Wastes.

A review of recent literature on electroplating and cyanide wastes begins with the U.S. EPA effluent guidelines and standards for the electroplating industry published in the Federal Register, September 7, 1979. Other topics covered in the review are economics of waste treatments and metal recovery, patents for treating plating effluents, cyanide detection and removal, and the toxicity of cyanide effluents to fish and aquatic life. (Cassar-FRC)
W81-03481

CHEMICALS AND ALLIED PRODUCTS,
Union Carbide Corp., South Charleston, WV.
R. F. Nelson, and T. W. Siegrist.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1455-1467, June, 1980. 131 Ref.

Descriptors: *Chemical wastes, *Organic compounds, Chemical industry, Wastewater treatment, *Water pollution control, Reviews, Industrial wastes.

A review of literature published in 1979 on water pollution by chemical industry wastes discusses capital outlays and energy requirements for pollution control, case reports of pollutants discharged into the environment, and waste water treatment methods, biological, physical, and chemical. Treatment methods for many chemicals are mentioned, including petrochemicals, phenol, cresols, organic solvents, explosives, ammonia, amines, polyoxyalkylene ethers, polyvinyl acetate, pharmaceuticals, acrylonitrile, polymers, pesticides, synthetic rubber, polyethylene, acids, polycyclic aromatic hydrocarbons, and many others. (Cassar-FRC)
W81-03482

PUMPING SEWAGE AND SEWAGE SLUDGE,
British Hydromechanics Research Association, Cranfield (England).
M. Johnson.
Effluent and Water Treatment Journal, Vol 20, No 12, p 575, 577-578, December, 1980. 1 Fig, 6 Ref.

Descriptors: *Pumping, *Sewage sludge, *Energy, Waste water treatment, *Sewage treatment, Computers, Aeration.

Increasing costs of sewage treatment demand a look at pumping procedures and equipment from the viewpoint of better efficiency and decreased costs. Major pumping problems are ragging (blockages by rag, plastics, and fibrous matter), especially troublesome in rotodynamic pumps and non-return valves, and energy consumption. Ragging may be alleviated by cutter devices at the pump inlet, using large passages and few blades; special pump designs, such as the Archimedian screw type; and careful design of non-return valves. Computer information may be used to save energy by keeping pump sizes minimal. The variability of sludge compositions and the non-Newtonian character of the fluids cause problems in pump design. Research is underway to detemine the properties of a wide variety of sludges and to further develop air injection techniques. Weatherproofing and submersible pumps are additional alternatives. (Cassar-FRC)
W81-03495

NEW JERSEY TOWNSHIP SOLVES GROUNDWATER PROBLEM WITH ACTIVATED CARBON,
Industrial Water Engineering, Vol 18, No 1, p 15, January/February, 1981.

Descriptors: *Activated carbon, *Groundwater pollution, *Drinking water, *Water treatment, Potable water, Water pollution treatment, Industrial wastes, Carcinogens, Chemical wastes, Carbon, Organic wastes, New Jersey, Rockaway Township.

Rockaway Township, a community in Morris County, New Jersey, discovered trichloroethylene (TCE) in two of its three public wells. Early tests showed TCE levels between 10 and 50 times the recommended levels for drinking water. Later tests on all three wells conducted as a result of complaints about taste and odor showed that all three wells were contaminated with two other potentially toxic organics, diisopropyl ether and methylene chloride. The township contracted for the supply of two adsorption tanks, each of which holds 20,000 pounds of granular activated charcoal. These tanks process about one million gallons of water per day, reducing organic pollutants to less than one part per billion and assuring safe drinking water from all three wells. Although four monitoring wells have been dug around the aquifer, the source of the chemicals has not been identified. (Carroll-FRC)
W81-03501

PROCESS FOR SIMULTANEOUS REMOVAL OF CADMIUM AND CYANIDE,
Rhode Island Univ., Kingston.
C. P. C. Poon, and K. P. Soscia.
Industrial Water Engineering, Vol 17, No 2, p 28-30, March/April, 1980. 2 Fig, 1 Tab, 3 Ref.

Descriptors: *Metal-finishing wastes, *Cyanide, *Cadmium, *Wastewater treatment, Heavy metals, Industrial wastes, Electrolysis, Sodium chloride, Electrochemistry.

A new process developed for the treatment of metal finishing wastewaters containing cadmium and cyanide involves the use of a compact reactor in which seawater or sodium chloride solution is electrolyzed below a column of metal finishing wastes containing the two heavy metals. Operational studies of the electrochemical reactor and of the treatment process included evaluation of the effects of variations in power input, rinse water depth, electrode spacing, initial pH, and initial metal concentrations. The initial cadmium concentration had the most significant effect on its removal, followed by rinse water depth and power input. The initial pH and electrode spacing had little effect on performance. The laboratory studies showed that both cadmium and cyanide in a metal finishing water could be simultaneously removed in an electroflotation process. Using the design investigated, a combination of lower power input and deeper wastewater column provides more effective treatment. (Carroll-FRC)
W81-03502

FUNDAMENTAL AND BASIC THEORIES REGARDING THE PROPER USE OF MODERN DAY ION EXCHANGE RESINS,
F. X. McGarvey, and M. C. Gottlieb.
Industrial Water Engineering, Vol 17, No 2, p 14-22, March/April, 1980. 11 Fig, 2 Tab, 19 Ref.

Descriptors: *Resins, *Ion exchange, Anion exchange, Cation exchange, Porosity, *Water treatment, Oxidation, Organic matter, Silica, Chemical composition, Chemical properties.

Producers of ion exchange resins have approached a variety of technical problems from the standpoint of the chemical and physical structure of the ion exchange resins in relation to chemical and physical attrition, silica removal, operating capacity, and organic fouling resistance. Ion exchange resins may be gel resins, which are beads consisting of a giant molecule of styrenedivinylbenzene with approximately one sulfonic acid group on each aromatic ring; first generation macroporous ion exchange resins, which consist of bundles of small microspheres stuck together to form a single bead, greatly increasing the surface area and porosity; and second generation macroporous ions, which provide greater control over pore size and surface area. The history of efforts to control organic fouling resistance, physical attrition of the resins, and colloidal dispersions of silica, and current practices with respect to each of these problem areas are discussed. The development and interpretation of laboratory information upon which to base design information and decisions is explained. The second generation macroporous ion exchange resins are shown to have operating capacities and leakage levels comparable to good quality gel resins. These new resins also have physical toughness, oxidation stability, and organic fouling resistance at least equivalent to that of the original macroporous resins. This paper was presented at the 40th annual meeting of the International Water Conference, held October 30 to November 1, 1979, in Pittsburgh, Pennsylvania. (Carroll-FRC)
W81-03504

TREATMENT OF NUCLEAR DRAIN WASTES WITH AN ELECTRO MAGNETIC FILTER AND ULTRAFILTRATION SYSTEM,
Japan Atomic Power Co., Ltd., Tokyo.
Y. Kurihara, M. Oda, K. Okugawa, Y. Sunaoka, and M. H. Kleper.
Industrial Water Engineering, Vol 17, No 1, p 14-19, January/February, 1980. 10 Fig, 3 Tab, 1 Ref.

Descriptors: *Filtration, *Radioactive wastes, *Wastewater treatment, Industrial wastewater, Industrial wastes, Electric power industry, Boiling water reactors, Nuclear reactors, Ultrafiltration, Process efficiency, *Nuclear powerplants.

Radioactive waste streams generated by light water reactors must be collected, monitored, and treated as necessary before reuse within the nuclear power plant or release to the environment. In boiling-water reactors, waste segregation is accomplished by establishing two major systems, one for comparatively high activity and low conductivity drains such as equipment drains and one for low activity and high conductivity drains such as floor drains. Owners of nuclear power plants are modifying their design philosophies concerning liquid radwaste processing systems in an effort to meet more stringent environmental regulations and to derive potential economic benefits from reduction of the increasing volumes of liquid and solid wastes produced. The Tsuruga Station of the Japan Atomic Power Company successfully replaced a precoat filter with a system containing electromagnetic filters followed by ultrafiltration units for the treatment of radioactive liquid wastes from equipment drains. Following extensive evaluations and short-term tests, a pilot plant was set up to study the performance of the system. The major dependent variables studied during the 2,000 hours of pilot plant operations included average flux, restoration of clean water flux, restoration of process flux, and repeatability of process flux. The production system has been in operation since 1977. The ultrafiltration unit system operates on a batch basis. Liquid waste reduction achieved with the ultrafiltration unit system has been 75 to 220 fold. The

ultrafiltration system flux has been significantly higher than the design value. There has been no decrease in system capacity since start-up. Installation of the electromagnetic filters followed by ultrafiltration units has resulted in a significant reduction in residual waste volume. (Carroll-FRC)
W81-03505

EXPLOSION AT A PESTICIDE MANUFACTURING PLANT,
Metropolitan Sanitary District of Greater Chicago, IL.
C. Lue-Hing, D. T. Lordi, S. Whitebloom, and G. Richardson.
Industrial Wastes, Vol 27, No 1, p 12-13, 34, January/February, 1981. 2 Fig, 2 Ref.

Descriptors: *Wastewater treatment, *Organophosphorus pesticides, *Water pollution prevention, Waste water disposal, Waste disposal, Pesticides, Accidents, Insecticides, Hazardous materials, *Chicago, Detention dams, Drainage ditches, Diversion dams, Water pollution treatment, Water pollution control, Sodium hydroxide, Chemical spills.

The Metropolitan Sanitary District of Greater Chicago (MSDGC) was called upon to deal with any pollution problems resulting from an explosion in a pesticide manufacturing plant in Chicago Heights in August of 1978. Unknown quantities of EPN, an organophosphorus insecticide, were flushed into nearby waterways as a result of fire fighting activities. EPN also entered the sewer system of the pesticide plant and a waste water treatment facility of Chicago Heights. A dam was constructed in the drainage ditch into which EPN was discharged to prevent the flow of the contaminated waters into a nearby creek. The waste water facility confined the inflowing EPN to one-third of the plant to maintain the integrity of its biological treatment processes. EPN contaminated inflow was held for further chemical treatment by alkaline hydrolysis and ultimate disposal to that part of the treatment facility still under normal operation. Sodium hydroxide was applied to the drainage ditch to treat residual EPN, and later the dam was removed, allowing reconnection with the local creek. Workers involved in the three-day emergency clean-up effort were examined by medical experts for ill health effects. This episode illustrates the importance of cooperation between industry and public authorities in ensuring a successful emergency response to toxic spills. (Geiger-FRC)
W81-03507

EFFECTIVE WASTEWATER TREATMENT IN POULTRY PROCESSING OPERATIONS,
Weaver (Victor F.) Co., Inc., New Holland, PA.
L. Newswanger, and H. E. Zuern.
Industrial Water Engineering, Vol 17, No 5, p 19-21, September/October, 1980. 1 Tab.

Descriptors: *Poultry, *Food-processing wastes, *Industrial wastewater, *Wastewater treatment, Activated sludge process, Chlorination, Filtration, Chemical treatment, Alum.

Poultry wastes contain high BOD, suspended solids, and grease, have varying pH wastewater flows, and require substantial treatment prior to discharge. A cost-effective treatment scheme was developed for a poultry processor in New Holland, Pennsylvania. It was decided that it would be more economical for the company to operate its own treatment plant as compared to paying a continuing surcharge on high strength wastewater discharged to the New Holland municipal treatment plant. First, coarse solids were removed, then grease and oil were floated. This was followed by dissolved air flotation for further solids and grease removal. The remaining BOD was removed in the activated sludge treatment system, and secondary clarification and microscreens were used to remove any residual suspended solids. The treated water was then chlorinated and discharged. Chemical treatment consisted of the addition of 300 mg/liter of alum and 3 mg/liter anionic polymer before air flotation. The final BOD averaged 17 mg/liter for October 1979 and 26 mg/liter for November. Suspended solids were 22 mg/liter for October and 28 mg/liter for November. The plant operates five days a week, and a large holding tank is being added to the system so the treatment plant will receive effluent seven days a week. (Small-FRC)
W81-03508

CENTRIFUGES BOOST SLUDGE HANDLING CAPACITY,
Houston Dept. of Public Works, TX.
R. S. Sarich, Jr.
Water and Wastes Engineering, Vol 17, No 4, p 38-39, April, 1980.

Descriptors: *Filtration, *Drying, *Sludge treatment, Centrifugation, Sludge disposal, Disposal, Waste water treatment.

Installed as an emergency measure in 1977, three large centrifuges now process up to half of the 80 tons per day sludge output from the Northside Waste Water Plant, Houston, Texas. This equipment requires less manpower, less space, and has lower chemical, utility and transportation costs than the vacuum filters and flash dryers also used in the plant. (Cassar-FRC)
W81-03533

WASTEWATER PLANTS SHOULD RECOVER COSTS FOR TREATING INDUSTRY DISCHARGES,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6C.
W81-03538

LAND DISPOSAL OF WASTEWATER FROM A BEET SUGAR FACTORY AND ITS EFFECT ON SOIL,
Tehran Univ. of Technology (Iran).
J. Shayegan, and M. Sanai.
Environmental Pollution (Series B), Vol 1, No 1, p 61-70, 1980. 2 Fig, 3 Tab, 7 Ref.

Descriptors: *Sugar beets, *Soil amendments, *Sludge disposal, *Waste water disposal, *Waste water treatment, Ultimate disposal, Sugar crops, Fertilizers, Agriculture, Sewage sludge, Nutrients, Salinity, Sewage effluents, Disposal, Iran.

A case study of land disposal of waste water from a sugar beet factory in Iran is described. This plant, operating about 100 days a year, has been applying its waste water to the same plot of land for 11 years. After initial sedimentation, the combined effluents have the following composition (all in mg per liter): pH, 12; BOD, 1070; COD, 3850; suspended solids, 356; Ca, 473; N, 19.6; P, 1.2; and Cl, 640. The waste water is generated during the winter and is stored in lagoons until needed in the growing season. Soil analysis of the disposal land shows that Ca and Mg have accumulated in the top layers (2 meters) of soil. Salinity is increased at all levels measured, up to 300 cm. Leachate reaching the groundwater appears to be essentially purified. Although the top layer of soil was encrusted with $CaCO_3$, the plot was renovated for agricultural use by removing the top 10 cm of soil, applying 120 tons of digested municipal sludge to each hectare, and plowing. Alfalfa and sugar beet produced 15% more biomass in this waste water treated plot than in control areas. (Cassar-FRC)
W81-03544

STAFFING FOR WASTEWATER COLLECTION SYSTEMS,
Spalding, DeDecker and Associates, Inc., Madison Heights, MI.
For primary bibliographic entry see Field 9C.
W81-03559

RANKING SLUDGE REMOVAL METHODS,
W. H. Boyle.
Water and Sewage Works, Vol 127, No 6, p 70, 72, June, 1980. 1 Fig, 8 Ref.

Descriptors: *Sludge excess, Sludge, Activated sludge, Cleaning, *Activated sludge process, Clarifiers, Clarification.

Scraping and suction are discussed as the two options available for removing sludge from the final clarifier of the activated sludge process. Mechanical scrapers can be used in rectangular basins having continuous chain-and-flight or traveling-bridge scrapers. Circular tanks having a rake mechanism with a drive unit at the center of the clarifier have also been used. A circular scraper does not have the same type of floor coverage as does a rectangular unit. Suction removal devices can be operated in rectangular basins using a traveling bridge, and circular basins using the tapered header or multiple-pipe drawoffs. Five important aspects of the suction removal devices are: rapid removal, minimum sludge agitation, maximum concentration, flexibility, and balanced hydraulic design. (Baker-FRC)
W81-03560

LOW-COST, LOW-ENERGY WASTEWATER TREATMENT GETTING NOTICE,
T. W. Greenlund.
Water and Sewage Works, Vol 127, No 5, p 56, 75, May, 1980. 1 Tab, 2 Ref.

Descriptors: *Wastewater treatment, *Operating costs, Energy conservation, Netherlands, West Germany, Europe, Aeration.

In general, West German-Holland design theory for wastewater treatment emphasizes aeration, with low organic loadings, a large aerator reactor mass, and moderate aeration reactor mixed liquor suspended solids concentrations. The process has been called the 'low-load aeration process' and offers significant advantages in the design and operation of wastewater facilities. One requirement in the system is a secondary clarifier with a very low surface settling rate, normally in the range of 250-350 Gpd/sq ft. This ensures the maintenance of the higher mixed liquor suspended solids, and together with the long detention times in the reactor allows rain water flows of 2.5-3.5 times the dry weather flows to be absorbed without detriment to the effluent quality. European treatment in general includes preliminary treatment, aeration, clarification, sludge thickening, and sludge dewatering. Unlike the American preliminary treatment practice of comminution and the return of ground materials to the waste flow, European practitioners generally use a mechanical screen to remove all solids from the wastewater at the outset of the treatment process. The advantages include oxidation, nitrification, and stabilization of sludge in the same reactor; simplicity of construction; superior oxygen transfer; lower volume of sludge; ease of operation; low cost; and long hydraulic detention times. (Baker-FRC)
W81-03563

HIGH-RATE THERMOPHILIC ANAEROBIC DIGESTION OF AGRICULTURAL WASTES,
Technion - Israel Inst. of Tech., Haifa. Environmental and Water Resources Engineering.
G. Shelef, S. Kimchie, and H. Grynberg.
Biotechnology and Bioengineering, Vol 22, No 10 (Symposium), p 341-351, 1980. 2 Fig, 6 Tab, 15 Ref.

Descriptors: *Farm wastes, *Thermophilic bacteria, Digestion, *Anaerobic digestion, Energy, Activated carbon, Cobalt, Methane, *Waste treatment, Disposal, Waste water treatment, Agricultural wastes.

Energy requirements for thermophilic anaerobic digesters operating at 8 days retention time with agricultural wastes such as cow manure, poultry manure, straw, and cotton plant wastes were 3800 kcal per cu meter per day for the largest reactor tested, 100 cu meter. Smaller digesters required more energy, 5400 for the 10 cu meter digester and 4700 for the 1 cu meter digester. Comparisons with the mesophilic system showed that thermophilic digestion (55C) had advantages at shorter retention times and higher organic loadings. Maximum thermophilic biogas production rate was 5.5 liters per liter-day (at 16 g per liter-day); mesophilic, 3.5. Cow manure, straw, chopped straw, or mixtures of all three showed efficiencies of about 0.23 liters per gram at a retention time of 10 days. Cotton solids,

even finely divided, had very low efficiencies, 0.01-0.06 liters per gram. Poultry manure was similar to cow manure, averaging an efficiency of 0.21 liters per gram. Powdered activated carbon at the level of 0.25-0.33% added to the feedstock of thermophilic digesters improved efficiency slightly. The mesophilic process was not affected. Granulated activated carbon did not aid either process. Cobalt added as carbonate or chloride (up to 45 mg per liter feed) did not improve the mesophilic process, but in the thermophilic process it improved gas production from 4.0 to 4.9 liters per liter-day. (Cassar-FRC)
W81-03577

CONTACT AERATION USING PLASTIC MEDIA--A CASE HISTORY,
Air Force Occupational and Environmental Health Lab., Brooks AFB, TX.
C-S. Huang, and G. A. Fishburn.
Water/Engineering and Management, Vol 128, No 2, p 30-31, February, 1981. 2 Fig, 3 Tab, 3 Ref.

Descriptors: *Aeration, *Contact filters, Biological oxygen demand, *Wastewater treatment, Plastics, Suspended solids, Nitrogen removal.

The plain asbestos plates used as the contact media in the aeration tanks of the wastewater treatment plant on the Brooks Air Force Base were replaced with Koro-Z honeycomb plastic media in an effort to improve the treatment efficiencies of the plant. The plant consists of a primary settling tank, a first-stage aeration tank, an intermediate settling tank, a secondary-stage aeration tank, a final settling tank, a chlorine contact tank, two polishing lagoons, and an irrigation lake. The biological oxygen demand (BOD5) removal efficiency was increased from 90% with the original asbestos filters to 95% with the plastic media. The suspended solids removal efficiency was increased with the plastic media. The suspended solids removal efficiency was increased from 92% to 97% after replacement of the media. Ammonia nitrogen removal efficiency is about 50% with the plastic media. The dissolved oxygen content of the final effluent has increased from 0 milligrams per liter to 3 to 4 milligrams per liter most of the time. The contact aeration system using the plastic media appears to achieve better results than can be obtained by a trickling filter or activated sludge system under comparable design criteria and is easier to operate, since there is no need for recirculation or sludge return. (Carroll-FRC)
W81-03581

LIMITED-SITE PUMPING STATION PROVIDES PROTECTION FROM BASEMENT FLOODING,
Hubbell, Roth and Clark, Inc., Bloomfield Hills, MI.
C. W. Myrold.
Water/Engineering and Management, Vol 128, No 3, p 56, 57, 104, March, 1981.

Descriptors: *Pumping plants, *Combined sewers, *Storm water, Network design, Michigan, Waste water treatment, Sewerage, Buildings, Combined sewer overflows, Southgate, Wyandotte.

The Pine Street Storm Relief Station corrected the basement flooding in Southgate and Wyandotte, Michigan, caused by backup of combined sewers during major storms and snow melting. The new facility is basically an 80 ft diameter vertical concrete caisson 64 ft deep and mostly below grade. The structure is tied to the existing porous rock formation with epoxy-grouted anchors. Designed to handle a 10 year frequency storm runoff, the system includes tunneled relief receptors, weir control system, and a retention basin. It sends small flows directly to the treatment plant and holds storm water for later treatment. Total cost was $6.9 million, and completion date, February, 1979. (Cassar-FRC)
W81-03583

FILTER MODIFICATIONS GIVE AN ADDED DIMENSION TO TERTIARY TREATMENT IN SHELBURNE,
C. J. Kretch.
Water and Pollution Control, Vol 119, No 2, p 10-11, February, 1981.

Descriptors: *Filters, *Tertiary treatment, Waste water treatment, Shelburne, Ontario, Effluent, Ultimate disposal.

After the rapid growth of population in Shelburne, Ontario, overloaded the municipal waste treatment system, secondary treatment plus tertiary filtration was chosen as the best alternative to produce the quality of effluent required for discharge into the sensitive environment. The system's four-compartment filter was modified to allow the operator to filter the same secondary effluent twice in a continuous process. Changes in the flow splitter box and inlet piping produced two separate two-compartment filters capable of removing enough suspended solids to remain within the total 12.7 kg BOD per day discharge limits. (Cassar-FRC)
W81-03591

SURVIVAL OF BACTERIA IN A SEWAGE EFFLUENT DISCHARGED TO THE CHALK,
Southern Water Authority, Hampshire (England).
M. J. Beard, and H. A. C. Montgomery.
Water Pollution Control, Vol 80, No 1, p 34-41, 1981. 6 Fig, 6 Tab, 5 Ref.

Descriptors: *Effluents, *Wastewater treatment, *Groundwater recharge, Wastewater facilities, Aquifers, Groundwater pollution, Substrates, *Bacteria, Coliforms, Calcareous soils.

The Alresford sewage treatment facility is one of many in the Hampshire area of the Southern Water Authority in Great Britain which discharge to the chalk, which is the principal aquifer of the area. Proposals were made in 1976 to change the method of introducing the effluent into the chalk at this works by excavating soakaways which would take advantage of the presumed capacity of the unsaturated zone to remove bacteria. The removal of coliform bacteria from the final effluent leaving the facility as a result of recharge into the chalk aquifer by means of the existing French drain network and of a newly constructed experimental soakaway system was investigated. Bacteriological studies were also conducted to determine whether the changes would create a risk of contaminating some watercress beds and a private borehole down the presumed groundwater gradient from the facility. Effluent discharged from the facility into the substratum was found to leave the immediate recharge area in a plume headed westward. Regardless of whether recharge was via the existing French drain or via the soakaways, removal of coliform bacteria was better than 99.99% at 500 meters from the point of recharge. The unsaturated zone was more efficient than the saturated zone in removing bacteria from the effluent. The effluent posed no risk to the watercress beds or to the private borehole. (Carroll-FRC)
W81-03592

AN ACCURATE LEVEL INDICATOR FOR THE MEASUREMENT OF SPECIFIC RESISTANCE TO FILTRATION,
University Coll. of Swansea (Wales). Biochemical Engineering Lab.
J. S. Knapp, M. G. Jones, G. Thomas, and J. A. Howell.
Water Pollution Control, Vol 80, No 1, p 117-120, 1981. 4 Fig, 3 Ref.

Descriptors: *Filtration, *Resistance, *Measuring instruments, Laboratory equipment, Sludge, *Wastewater treatment.

Specific resistance to filtration is widely used as a measure of the filtration properties of sewage sludges. The measurement of specific resistance to filtration is very tedious and time-consuming because of the need for repeatedly measuring elapsed time and volume of filtrate voided over a period varying from 5 or 10 minutes to more than one hour. Apparatus designed by Wuhrmann to automate this measurement simply measures the time taken for the accumulation of a fixed volume of filtrate between two set volumes. However, the underlying assumption that the non-linear portions of the graph always fall at the same volumes may not be valid. An apparatus has been developed which overcomes the intrinsic problems of the Wuhrmann apparatus and allows accurate automatic determination of time and volume of filtrate voided over time. This apparatus has been used successfully for several years in the measurement of the specific resistance to filtration in conjunction with a pressure bomb filter. With slight modification it could be used with the more conventional vacuum filtration apparatus. The device can be used in many situations for automatic measurement of the rate of accumulation of any conducting liquid or any change in the level of such a liquid. In addition, the cost of the apparatus is very low. (Carroll-FRC)
W81-03594

CL2 RING SYSTEM,
Great Falls Wastewater Treatment Plant, MT.
D. F. Brown.
Water/Engineering and Management, Vol 128, No 2, p 28-29, February, 1981. 1 Fig, 2 Tab.

Descriptors: *Wastewater treatment, *Chlorination, *Coliforms, Residual chlorine, Wastewater facilities, Contact beds.

The failure of wastewater treatment plants to simultaneously satisfy chlorine residual maximum and fecal coliform limitation requirements can be attributed to inadequate chlorine contact basin capacity and insufficient mixing of the chlorine solution with the wastewater. Although the Great Falls, Montana, activated sludge plant incorporated substantial improvements in the chlorine contact basin design, the plant was unable to meet both requirements simultaneously. Dye testing showed that the actual contact time of the wastewater in the basin was about half the expected time. The redwood baffles mounted at four points along each contact basin to help prevent short circuiting and provide additional mixing were modified by covering all but a 3 foot wide section of the baffle with Visqueen. Every other baffle was open for 3 feet either at the top or at the bottom, creating an over-under flow pattern. This increased baffling visibly created more turbulence in the basins and caused a measurable drop in the fecal coliform count. To achieve further improvements, a plan was devised to introduce chlorine solution into the treated wastewater as it leaves the final settling basins and flows into the launders. For this purpose, a continuous loop of 1.5 inch flexible polyvinyl chloride irrigation tubing was first attached to each final basin's scum baffle below water level. Holes were drilled in this tubing at 12 inch intervals around the circumference of the ring. Chlorine solution was piped to the ring diffuser from the plant's main chlorinator, thereby injecting chlorine into each final basin in about 320 places before the treated wastewater goes into the launders. The net effect has been to lower the effluent's fecal coliform level below permit limitations without exceeding chlorine residual maximum levels. The ring system has also resulted in reduced basin maintenance and improved basin appearance. (Carroll-FRC)
W81-03596

ODOR CONTROL IN WASTEWATER PLANTS,
Onondaga County, New York, Dept. of Drainage and Sanitation.
R. R. Metcalf.
Water/Engineering and Management, Vol 128, No 2, p 39, 76, February, 1981.

Descriptors: *Odor control, *Wastewater facilities, Odors, Septic wastewater, Biological treatment, Anaerobic digestion, Sulfur compounds, Aeration, Chlorination, Solids, Filtration.

Odor complaints are a major contributor to the poor public image of the wastewater treatment industry. The objective should be to eliminate or reduce all odors from collection and treatment facilities. The most objectionable odors are usually a direct result of septic conditions somewhere in the system which permit the production of hydrogen sulfide and related organic sulfur compounds. When septicity is the major cause of odors, steps

should be taken to eliminate aerobic conditions in all areas except where they can be controlled. Cleanliness, constant movement, and aeration provide the best means of preventing the accumulation and stagnation of sewage and sludge which lead to odor production. Inexpensive drip stations can be used to add chlorine to wastes entering the plant in a septic condition. Immediate and rapid disposal of organics accumulating in grit and screening will minimize odors. When this is not possible, treatment to inhibit bacterial decomposition should be tried. Equipment facilitating the removal of gases, liquids, and solids from the digester should be adequate and functioning properly if odor problems are to be minimized. Odors from trickling filters usually result from excessive solids trapped on or in the filter media. Pretreatment at the source or within the plant can reduce this problem significantly. Wastes having excessive biological oxygen demand levels should be oxidized prior to the trickling filter. Odorous sludge may be treated by spraying with hypochlorite or sprinkling with lime to inhibit biological activity. Although masking agents can be effective in situations requiring immediate attention, they are undesirable and expensive alternatives in the long run. (Carroll-FRC)
W81-03599

5E. Ultimate Disposal Of Wastes

ILLINOIS BIOMASS RESOURCES: ANNUAL CROPS AND RESIDUES: CANNING AND FOOD-PROCESSING WASTES - PRELIMINARY ASSESSMENT,
Argonne National Lab., IL.
A. A. Antonopoulos.
Illinois Institute of Natural Resources, Chicago. Document No 80/22, November, 1980. 110 p, 14 Fig, 41 Tab, 44 Ref, Append.

Descriptors: *Illinois, *Biomass, Waste recovery, Energy sources, Methane, *Farm wastes, Crop yield, Canneries, *Food-processing wastes, Industrial wastes, Fermentation, Gasification, Recycling, Fuel, Waste recovery, *Waste disposal.

Illinois, a major agricultural and food-processing state, produces vast amounts of renewable and potentially valuable plant material. Two main biomass resources have been evaluated in this investigation: (1) annual crops and their residues, and (2) canning and food processing wastes. There was also an environmental and economic evaluation of products that could be generated from biomass. Three technologies to convert biomass to fuels were examined: (1) direct combustion to generate heat and electricity; (2) fermentation to yield ethanol for gasohol; and (3) gasification to produce methane. Use of biomass as a source of other valuable chemicals was also investigated. Results indicate that of the 39 million tons of residues generated in 1978 in Illinois from seven main crops, about 85% was collectible. The thermal energy equivalent of this material is 658 x 1,000,000 Btu, or 0.66 Quad. By fermenting 10% of the corn grain grown in Illinois, approximately 323 million gallons of ethanol could have been produced in 1978. Another three million gallons of ethanol were available in 1978 from the wastes generated by food-processing establishments. The report recommends a thorough evaluation of the potential for biomass resources. (Garrison-Omniplan)
W81-03290

ON-SITE WASTEWATER TREATMENT AND DISPOSAL SYSTEMS (ENVIRONMENTAL AND HEALTH EFFECTS),
Patterson Associates, Inc., Chicago, IL.
For primary bibliographic entry see Field 5D.
W81-03291

BEHAVIOR OF CD, NI, AND ZN IN SINGLE AND MIXED COMBINATIONS IN LANDFILL LEACHATES,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 5B.
W81-03338

METHODS OF SOIL HYDRAULIC CONDUCTIVITY DETERMINATION AND INTERPRETATION,
ABC Dirt Soil Scientist, Seattle, WA.
For primary bibliographic entry see Field 2G.
W81-03339

MANAGEMENT OF HAZARDOUS WASTE BY UNIQUE ENCAPSULATION PROCESSES,
Environmental Protection Polmers, Hawthorne, CA.
H. R. Lubowitz, and C. C. Wiles.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 91-102. 3 Fig, 4 Tab, 10 Ref.

Descriptors: *Hazardous materials, *Waste disposal, *Waste management, *Polymers, *Encapsulation, Toxicity, Waste characteristics, Waste storage, Economics, Water pollution prevention.

Encapsulation was developed as a means of managing extremely toxic wastes which cannot be managed in an envronmentally acceptable manner by other means. Polyolefin (primarily high- and medium-density polyethylene), polybutadiene, polyurethane, and fiber glass/epoxides have been used to produce encapsulated modules of hazardous waste. Modifications of these polymer systems have made it possible to produce encapsulated modules capable of handling different waste forms--dry unconfined wastes, sludges, and containerized wastes. The encpsulation systems are compatible with a wide range of waste compositions, and the modules they produce have been shown to have high resistance to chemical and mechanical stresses. They can be expected to provide hazardous waste containment over exceptionally long periods of time. The nature of the systems is such that they can be tailored to different waste characteristics and containment objectives. For example, the encapsulated waste can be stored under strict control and removed if required, or it can be disposed of under various regimes. Each process discussed is in a different stage of development. Though uncertain, the preliminary economics of these systems appear to be acceptable. If future cost considerations take performance capabilities into account, these systems are expected to become more economically viable. (Brambley-SRC)
W81-03343

ESTIMATION OF POLLUTION POTENTIAL OF INDUSTRIAL WASTE FROM SMALL-SCALE-COLUMN LEACHING STUDIES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Engineering Div.
P. G. Malone, L. W. Jones, R. A. Shafer, and R. J. Larson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, PA., Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 103-118. 6 Fig, 8 Tab, 5 Ref. EPA-IAG-D4-0569.

Descriptors: *Leachates, *Industrial wastes, *Heavy metals, *Water pollution sources, Leaching, Water quality standards, Waste characteristics, Pollutants, Sludge disposal, Toxicity.

Two industrial wastes, a nickel-cadmium battery sludge and a pigment production sludge, and three solidified/stabilized products produced from them were subjected to long-term leaching in small (10 cm diameter by 122 cm) plexiglass columns. Leachate from untreated nickel-cadmium battery sludge contained large amounts of soluble salt (probably mostly sodium nitrate) and exceeded drinking water standards for mercury, manganese and selenium. The pigment production sludge produced leachates exceeding drinking water standards for cadmium, chromium, mercury, manganese, lead, and sulfate. Of the three solidification/stabilization processes evaluated, the process using soluble silicate and cement additives gave the best containment of the heavy metals, but exceeded the untreated sludges in initial losses of soluble species. A flyash and lime additive process produced a product which lowered the overall conductivity of the leachate but did not significantly lower the losses of the heavy metals. A urea-formaldehyde treatment process greatly increased the rate of loss of most contaminants to the leachate. The overall effect of the treatment processes on contaminant loss may be lessened because of the relatively low loss of pollutants from the untreated sludges. After 2 years leaching time, much less than 1% of all heavy metal pollutants had been leached from any of the sludge samples except from the urea-formaldehyde treated sludge. Since the treatment processes did not appear to increase the containment of toxic metals, other experimental methods should be undertaken. (Brambley-SRC)
W81-03344

ORGANIC LEACHATE EFFECTS ON THE PERMEABILITY OF CLAY LINERS,
Texas Agricultural Experiment Station, College Station. Dept. of Soil and Crop Sciences.
For primary bibliographic entry see Field 8D.
W81-03345

MEMBRANE LINER SYSTEMS FOR HAZARDOUS WASTE LANDFILLS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 8G.
W81-03346

DURABILITY OF LINER MATERIALS FOR HAZARDOUS WASTE DISPOSAL FACILITIES,
Matrecon, Inc., Oakland, CA.
For primary bibliographic entry see Field 8G.
W81-03347

INSTALLATION PRACTICES FOR LINERS,
Southwest Research Inst., San Antonio, TX.
For primary bibliographic entry see Field 8G.
W81-03348

IDENTIFICATION OF HAZARDOUS WASTE FOR LAND TREATMENT RESEARCH,
Little (Arthur D.), Inc., Cambridge, MA.
J. B. Berkowitz, J. C. Harris, and B. Goodwin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 168-177. 3 Tab, 14 Ref.

Descriptors: *Hazardous materials, *Land disposal, *Wastewater disposal, *Wastewater treatment, Cation exchange, Soil properties, Heavy metals, Industrial wastes, Organic compounds, Inorganic compounds, Steel industry.

Land treatment, in which biological, chemical, and physical processes of the soil detoxify the wastes, is a potential method for the disposal of hazardous wastes. A method has been developed for identifying hazardous waste streams which may be suited to this method of disposal. The amount of waste, number of plants, waste composition, and annual rate of generation of each waste component were determined. The cation exchange capacity (CEC) of a soil must be considered when wastes containing heavy metals are to be disposed. Assuming a land disposal site of 40 ha, and CEC's of < 5 to 15 $<$, only one waste could be considered a candidate for land treatment - spent sulfuric acid pickle liquor from the steel finishing industry. Organic chemicals are identified as possible candidates for land treatment based on their persistence in soil. The most promising wastes will require further

research, field testing, and verification. (Brambley-SRC)
W81-03349

FACTORS INFLUENCING THE BIODEGRADATION OF API SEPARATOR SLUDGES APPLIED TO SOILS,
Texas Agricultural Experiment Station, College Station. Dept. of Soil and Crop Sciences.
K. W. Brown, K. C. Donnelly, J. C. Thomas, and L. E. Deuel, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 188-199. 12 Fig, 5 Tab, 13 Ref.

Descriptors: *Sludge digestion, *Hydrocarbons, *Oil industry, *Microbial degradation, Industrial wastes, Land disposal, Soil moisture, Soil texture, Soil temperature, Nutrients, Application rates.

Biodegradation of the organic components of hazardous industrial wastes is essential for complete disposal. Information on the rates of degradation as a function of edaphic and management factors is necessary in order to properly design a land treatment system and to estimate the level of management and the length of time to achieve closure following the last application. The influence of various environmental parameters on biodegradation of a refinery and a petrochemical waste was evaluated using a continuous flow soil respirometer. Biodegradation rates of the two wastes were measured by collecting the carbon dioxide evolved and by residual hydrocarbon analysis. The microbial population was determined six months after incubation had begun. The environmental parameters studied included soil texture, soil moisture, mineral nutrient amendments, application rates, application frequency and temperature. Maximum degradation rates were achieved with the Norwood sandy clay at a temperature of 30C. The half life of the refinery sludge was 141 days, while that of the petrochemical waste was 692 days. The addition of mineral nutrients was not effective in increasing the rate of biodegradation of the refinery waste, but did produce a small increase in the biodegradation rate of the petrochemical waste. Degradation was generally optimum at field capacity and decreased when the soil moisture content was greater or lower than this level. Biodegradation rates of both wastes increased with application rate, to a maximum, then declined. Small frequent applications of both wastes were more readily degraded than one single equivalent application. (Brambley-SRC)
W81-03350

REVIEW AND PRELIMINARY STUDIES OF INDUSTRIAL LAND TREATMENT PRACTICES,
Science and Education Administration, Beltsville, MD. Biological Waste Management and Organic Resources Lab.
R. L. Chaney, S. B. Hornick, and L. J. Sikora.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 200-212. 1 Tab, 85 Ref.

Descriptors: *Land disposal, *Literature review, *Chromium, *Tannery wastes, Heavy metals, Soil chemistry, Soil-water-plant relationships, Proteins, Phytotoxicity, Leaching, Groundwater pollution.

There are a number of ways in which metals may enter the food chain, however the 'soil-plant barrier' can keep the levels below the injurious levels for some metals. Chromium is one such metal, so wastes containing it could be applied to land. Chromium exists in two redox forms: chromic (reduced) and chromate (oxidized). Chromate is rapidly reduced in soils to chromic, which is adsorbed and chelated by soils and becomes unavailable to plants. Chromium-containing wastes from the leather manufacturing industry are candidates for land treatment, because their protein content provides a nitrogenous fertilizer. When used in this way the wastes seldom caused any phytotoxicity, although crops were somewhat enriched in chromium in the first year. It is unlikely, but not proved, that chromium will be leached into the groundwater. The chromic-chromate equilibrium is a key factor, especially in chromium-rich soils. (Brambley-SRC)
W81-03351

ASSESSMENT OF HYDROCARBON EMISSIONS FROM LANDTREATMENT OF OILY SLUDGES,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5B.
W81-03352

CLOSURE TECHNIQUES AT A PETROLEUM LAND TREATMENT SITE,
For primary bibliographic entry see Field 5G.
W81-03353

EVALUATION OF CATALYZED WET OXIDATION FOR TREATING HAZARDOUS WASTE, IT Enviroscience, Knoxville, TN.
For primary bibliographic entry see Field 5G.
W81-03357

EMERGING TECHNOLOGIES FOR THE DESTRUCTION OF HAZARDOUS WASTE, ULTRAVIOLET/OZONE DESTRUCTION,
Ebon Research Systems, Washington, DC.
For primary bibliographic entry see Field 5D.
W81-03358

TOP SEALING TO MINIMIZE LEACHATE GENERATION - STATUS REPORT,
SMC-Martin, King of Prussia, PA.
For primary bibliographic entry see Field 5G.
W81-03359

REMEDIAL ACTIONS AT UNCONTROLLED HAZARDOUS WASTE SITES,
SCS Engineers, Covington, KY.
For primary bibliographic entry see Field 5G.
W81-03361

TERRAIN, LAND USE AND WASTE DRILLING FLUID DISPOSAL PROBLEMS, ARCTIC CANADA,
Ottawa Univ. (Ontario).
H. M. French.
Arctic, Vol 33, No 4, p 794-806, December, 1980. 10 Fig, 1 Tab, 13 Ref.

Descriptors: *Drilling fluids, *Industrial wastes, *Liquid wastes, Hydrocarbons, Canada, Arctic, Sumps, Tundra, Terrain analysis, Underground waste disposal.

A survey of over 60 abandoned wellsites in the Mackenzie Delta, the high Arctic Islands, and the interior Yukon Territory was conducted to evaluate the effectiveness of the Territorial Arctic Land Use Regulations in Canada as they relate to exploratory drilling for hydrocarbons and to the disposal of waste drilling fluids. Land use permits for these drilling operations require that waste drilling fluids be contained completely in below-ground sumps and that these sumps be filled upon completion of the well. The survey indicated that about 25% of the wellsites experienced terrain problems related either directly or indirectly to sumps and/or to the containment of waste drilling fluids. General site conditions and the timing and nature of the drilling operation were more important than age in determining problems with the sumps. The three major types of problems were non-containment of wastes during drilling, melt-out problems during summer operations, and restoration problems occurring either during restoration or in subsequent years. The lowest incidence of problems is associated with one-season winter drilling operations. Both two-season winter drilling, in which the sump is left open during the summer, and one-season summer drilling operations present more problems with sumps. Although certain sump-related problems can be resolved by more rigorous planning, careful operating techniques, and strict application of present regulations, alternate methods of disposal must be considered in other areas of high potential terrain and toxicity damage. (Carroll-FRC)
W81-03463

PETROLEUM PROCESSING AND COAL CONVERSION WASTES,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W81-03478

RADIOACTIVE WASTES,
Oak Ridge National Lab., TN.
B. G. Blaylock, and C. S. Fore.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1467-1494, June, 1980. 4 Tab, 179 Ref.

Descriptors: *Radioactive waste disposal, Nuclear wastes, Radionuclides, *Waste disposal, Ultimate disposal, Disposal, Waste treatment, Path of pollutants, Monitoring, Geology, Chemical reactions, *Industrial wastes, Water pollution sources, Thermal pollution, Radioecology, Social aspects, Reviews.

The increased concern with the problem of radioactive waste disposal is reflected in the large number of publications on this subject in 1979. A literature review summarizes three symposia and a list of technical reports in a series of tables which includes authors, organizations, and subjects. Several comprehensive reviews and reports have been published concerning disposal of radioactive wastes, high- and low-level, in the U. S. and in European countries. Other subjects included in this compilation are site selection and geology, migration and leaching of radionuclides, modeling studies, techniques for monitoring radiation near facilities, temperature increases in stored waste, thermal stability of rock formations in disposal sites, design of waste repositories, chemical and physical changes occurring in disposal sites, processes for solidifying wastes, volume reduction, storage away from the reactor, design and performance of containers to store high-level waste in geologic formations, risks to man and the environment from stored wastes, socioeconomic aspects, and criteria and standards. (Cassar-FRC)
W81-03483

SOLID WASTES AND WATER QUALITY,
Washington Univ., Seattle.
For primary bibliographic entry see Field 5B.
W81-03484

DISPOSAL FACILITY DESIGN FOR OIL-FIRED BOILER SLUDGE,
A. G. Lazarus, Jr., and C. M. Palesh.
Power Engineering, Vol 85, No 3, p 74-76, March, 1981. 3 Fig, 3 Tab.

Descriptors: *Solid wastes, *Sludge disposal, *Powerplants, Vanadium, Fly ash, Ultimate disposal, Industrial wastes, Water pollution sources, Disposal, Heavy metals, New England Power Company, Metals, Landfills, *Leachate, Monitoring, Observation wells, Water quality.

On-site disposal in trenches was the most environmentally acceptable alternative for disposing of combustion residue from the New England Power Company's oil-fired boilers. After heavy metal precipitation with lime, the sludge slurry is dried in the ultimate disposal site, a trench type landfill equipped with permanent leachate collection systems. The leachate is piped back to the plant's waste water treatment system. The site can accommodate 50,000 cu yards of dried sludge. The PVC-lined, filled trenches are covered with PVC liner

and soil, then planted with grasses and legumes. A water quality monitoring system includes observation wells and river sampling. The dried sludge contains about 6% vanadium. Increased vanadium was detected in groundwater samples during the first year of operation. (Cassar-FRC)
W81-03515

DISPOSAL WELLS REALLY CAN WORK,
V. P. Amy.
Water and Wastes Engineering, Vol 17, No 7, p 20-23, July, 1980. 1 Fig.

Descriptors: *Disposal wells, *Well testing, *Waste disposal, Well drilling, *Injection wells, Performance evaluation, Municipal wastes, Dolomite, Florida.

West Palm Beach, Florida, has tested, drilled and operated successful cost-effective disposal wells without contaminating aquifers. It has disposed of 13 billion gallons of effluent in this way since 1977. A 12-inch diameter, 3500-ft deep test well revealed the presence of the Boulder Zone (cavernous dolomite) which can accept large amounts of treated effluents. In construction of the test well, four strings of casing were used and pipes were set at various levels for monitoring purposes. Three disposal wells were dug at a cost of 1.82 million dollars per well. Currently the plant is treating and disposing of 20 to 22 mgd. Peak injection rates of as much as 25,000 gpm are used. When the wells were used for disposal, West Palm Beach stopped dumping treated effluent into Lake Worth and an important step was taken in cleaning up local waterways. (Small-FRC)
W81-03532

LAND DISPOSAL OF WASTEWATER FROM A BEET SUGAR FACTORY AND ITS EFFECT ON SOIL,
Tehran Univ. of Technology (Iran).
For primary bibliographic entry see Field 5D.
W81-03544

UPTAKE OF FLUORIDE BY RYEGRASS GROWN IN SOIL TREATED WITH SEWAGE SLUDGE,
Water Research Centre, Stevenage (England).
For primary bibliographic entry see Field 5B.
W81-03578

ON-SITE SEWAGE DISPOSAL ALTERNATIVES COMPARED,
Wood County Health Dept., Parksburg, WV.
R. G. Weigand.
Water/Engineering and Management, Vol 128, No 1, p 76-78, January, 1981. 2 Tab, 5 Ref.

Descriptors: *Wastewater disposal, Waste disposal, Land disposal, Evapotranspiration, Filters, Wastewater facilities.

Various alternatives to the septic-tank leach-field approach of handling sewage disposal have been considered in West Virginia, including variations of evapotranspiration mounds, dual leach fields, shallow-trench leach fields, filter beds, and combination evapotranspiration-percolation mounds. After studying several systems and analyzing reasons for their success or failure, the following recommendations were made for the use of a WVET mound. The engineer and sanitarian must be very specific as to the location of the mound, as not all locations are suitable. There must be strict enforcement of water table and soil percolation requirements. Ideal sun and wind exposure must be considered during site selection. Water conservation methods should be put into use by the consumer. A final inspection of the installation is necessary. For employing a NoDak mound these recommendations were made: proper sun and wind conditions must be noted during site selection. The presence of a garbage grinder and washer contributes greatly to system failures. Use of a pump dosing system does not necessarily improve the frequency of failure over mounds using gravity flow. Poor surface drainage is a critical factor in failure. The mean size is also significant.
W81-03580

DISPOSAL OF SEPTIC-TANK CONTENTS IN CYPRUS,
Engineering-Science, Inc., Arcadia, CA.
R. M. Bradley.
Water Pollution Control, Vol 80, No 1, p 131-137, 1981. 8 Tab, 25 Ref.

Descriptors: *Land disposal, *Septic tanks, *Cyprus, Septic sludge, Waste disposal, Wastewater, Wastewater analysis, Waterwater collection, Odors, Metals, Public health, Absorption.

Septic tanks are still widely used in urban areas in Cyprus pending construction of sewerage and sewage-treatment systems. Although the septic-tank effluents are usually discharged to absorption pits, these pits are frequently overloaded, and regular pumping out must be employed. In the capital city of Nicosia, contents of the absorption pits and septic tanks are disposed of on land, giving rise to problems of odor and posing a potential health hazard. Septage in Nicosia is a combination of septic-tank, holding-tank, and absorption pit contents removed by road tankers to a land disposal area. This septage has characteristics similar to septic tank supernatant elsewhere, rather than to septage derived from conventional septic tank systems. The absorption pits are generally overloaded by at least a factor of three. The septage is disposed to a eucalyptus forest at a hydraulic rate of 100 cubic meters per hectare per day. Septage was found to be increasing the metal content of the soil in the disposal area. The addition of lime to a sample of septage showed that if this were practiced the sewage smell could be prevented and the fecal coliform level could be reduced to zero. The land disposal of septage provides an acceptable interim solution to sewage-disposal problems in the city pending the early opening of sewage treatment facilities. However, the land disposal area should be increased to eliminate waterlogging, and the eucalyptus trees should be monitored to assess the effects of increasing metal and boron levels in the soil. Lime additions could be used to minimize the occasional odor problems that arise during the summer. (Carroll-FRC)
W81-03593

5F. Water Treatment and Quality Alteration

APPLICATION OF ION EXCHANGE AND ULTRAFILTRATION FOR REMOVAL OF COLOR FROM GROUNDWATER,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
K. J. Lowery.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209058, Price codes: A07 in paper copy, A01 in microfiche. MS Thesis, May 1981. 122 p, 33 Fig, 17 Tab, 36 Ref, 2 Append. OWRT-A-132-MISS(1), 14-34-0001-0126.

Descriptors: Resins, *Ion exchange, *Color removal, *Ultrafiltration, *Water treatment, Water supply, Groundwater, Membranes, IRA-940, UM membrane, PM membrane, Diaflow membrane, Batch study, Column study.

Ion exchange and ultrafiltration were studied as treatment alternatives for removal of naturally occurring organic color from a groundwater supply. Assessment of five strong base and one weak base anion exchange resins by batch and column studies showed that excellent color removal could be obtained with IRA-940, a strong base divinyl benzene resin. The resin showed excessive decrease in capacity upon regeneration. Batch studies showed that IRA-940 could be regenerated to 80% of its original capacity; three column runs showed a reduction in treatment from the initial 3,300 bed volumes to 750 and 375 after the first and second regenerations, respectively. The major anions in the water - becarbonates, chlorides and phosphates - were monitored along with the color for all batch and column studies. In the column studies, these ions equilibrated at approximately the raw water concentration within 30 hours; however, color continued to be removed. Ultrafiltration with Diaflow membranes of 2000 to 50,000 molecular weight cutoff showed greater than 95% color removal with a UM 10 membrane rated at 10,000 molecular weight cutoff. Color reduction with a commercially available PM 10 membrane rated at 10,000 molecular weight cutoff provided generally less than 60% removal. Removal comparable to that achieved by the UM 10 could be obtained by pH adjustment of the feed to 5.0 or below.
W81-03262

THE RELATIONSHIP BETWEEN HIGH SODIUM LEVELS IN MUNICIPALLY SOFTENED DRINKING WATER AND ELEVATED BLOOD PRESSURES,
Illinois Univ. at the Medical Center, Chicago. School of Public Health.
G. R. Brenniman, W. H. Hallenbeck, R. J. Anderson, and A. T. Baukus.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-212615, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center, Illinois University, Urbana, Research Report 158, 1981. 27 p. 7 Tab, 20 Ref, 3 Append.

Descriptors: *Illinois, *Massachusetts, *Sodium, *Saline water, *Drinking water, Food habits, Urine, Analysis of variance, Municipal water, Water softening, Water analysis, Foods, Epidemiology, Public health, *Blood pressure.

Hypertension is a major affliction affecting 15-20% of the adult populations of industrialized nations. Studies which indicate that sodium is an important factor in hypertension have primarily investigated food sources and ignored water as an additional source of sodium. A recent study in Massachusetts found that a group of high school sophomores exposed to 107 mg/l sodium in their drinking water had significantly higher blood pressures than a control group exposed to 8 mg/l sodium. To test the validity of these findings, high school juniors and seniors in the Chicago metropolitan areas of LaGrange and Westchester were studied. The drinking water in LaGrange has a much higher concentration of sodium. Blood pressure measurements, and a questionnaire to obtain data affecting these measurements, were obtained for all participants; urine samples were collected from some students. A model was developed using only the most important covariates---salty food index, daily cigarette use, and the Quetelet index. The community variable was a dummy variable. An analysis of the results showed that male and female systolic blood pressures (SBP) in LaGrange were not higher than in Westchester ($p > 0.05$). However, the male and female diastolic blood pressures (DBP) were significantly higher in the high-sodium community ($p < 0.05$). The DBP increases were not as large as in the Massachusetts study. The long-term significance of these findings is unknown. It is recommended that an epidemiological study be conducted to determine absolute affects of additional sodium on blood pressure. (Atkins-Omniplan)
W81-03293

APPLICATION OF ADVANCED TECHNOLOGY FOR POTABLE WATER SUPPLIES IN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
G. E. Speitel, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-212359, Price codes: A09 in paper copy, A01 in microfiche. Completion Report, 1981. 161 p, 57 Fig, 25 Tab. OWRT-A-109-NC(1), 14-34-0001-9035.

Descriptors: *Water treatment, *Ozone, *Chlorine dioxide, Granular activated carbon, Biological activated carbon, Dissolved air flotation, European water treatment, *Activated carbon, Costs, Evaluation, *Flotation.

Five European water treatment techniques are identified as having a definite potential for application in the United States: ozone, chlorine dioxide, granular activated carbon, biological activated carbon and dissolved air flotation. Ozone is an attractive alternative to chlorine as a primary disin-

fectant. It may also be useful for pretreatment purposes, trihalomethane precursor removal and overall organics oxidation. Cost considerations and a very short-lived residual are responsible for the limited use of ozone in the United States. Chlorine dioxide is well suited for use both in pretreatment and posttreatment to provide a distribution system residual. Lower chlorinated organics formation, reduced pH dependence and a more persistent residual allow it to compete with chlorine. The major drawback with chlorine dioxide is its relatively high cost. Granular activated carbon is attractive for the treatment of waters contaminated withorganic chemicals. Difficulties are presently encountered in assessing the need for such treatment and in evaluating process performance. An additional factor is the significant costs associated with the process, particularly for replacement of exhausted carbon. Biological activated carbon is a new process which is a variation of granular activated carbon treatment. Its potential advantage is the possibility for a significant increase in activated carbon service life. Biological activated carbon is now the subject of considerable research as basic questions about process capabilities remain unanswered. Dissolved air flotation provides an alternative to sedimentation. Advantages over sedimentation include: a sludge thickening capability, a larger hydraulic surface loading and better algae removal.
W81-03364

ALKANOLAMINE SALTS OF MALEAMIC ACIDS AS ANTI-CORROSION AGENTS IN AQUEOUS SYSTEMS,
BASF, Ludwigshafen am Rhein (Germany, F. R.).
K. Oppenlaender, W. Kindscher, and E. Getto.
U.S. Patent No 4,207,285, 5 p, 1 Tab, 11 Ref; Official Gazette of the United States Patent Office, Vol 995, No 2, p 646, June 10, 1980.

Descriptors: *Patents, *Industrial water, *Water treatment, *Corrosion control, Inhibitors, Chemical reactions, Cooling water.

An object of the invention is to provide additives for aqueous systems such as industrial purification and cooling processes, which are water-soluble, possess a good anti-corrosion effect, show very little tendency to foam and show very little sensitivity to water hardness. This process prevents the corrosion of metals in aqueous systems by means of low-foam corrosion inhibitors consisting of alkanolamine salts of maleamic acids. (Sinha-OEIS)
W81-03375

METHOD FOR RECOVERING AND TREATING BRINE FROM WATER SOFTENER REGENERATION,
Water Refining Co., Inc., Middletown, OH. (Assignee).
S. H. Davis, and J. E. Etzel.
U.S. Patent No 4,207,397, 7 p, 2 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 995, No 2, p 677, June 10, 1980.

Descriptors: *Patents, *Water treatment, *Water softening, Demineralization, Brines, Recycling, Cation exchange, Chemical precipitation, Separation techniques, Brine disposal, Regeneration.

Cation exchange water softeners may be regenerated and, then, the regenerant wastes (brine) recovered, treated, and recycled. The result is a closed system which is ecologically beneficial. The regenerant brine is captured in as concentrated a form as possible and then treated with a precipitant such as sodium or potassium carbonate or mixtures of sodium or potassium carbonate with sodium or potassium hydroxide. Calcium and magnesium compounds are precipitated and the supernatant contains sodium or potassium chloride. These are separated within the brine treatment tank, the precipitate being disposed of as a sludge or sludge cake and the supernatant being recycled to the water softener at the time of further regeneration. (Sinha-OEIS)
W81-03376

REVERSE OSMOSIS APPARATUS EMPLOYING A RECIPROCATING MEMBRANE CARTRIDGE,
Desalination Systems, Inc., Escondido, CA. (Assignee).
D. T. Bray.
U.S. Patent No 4,208,289, 6 p, 3 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 995, No 3, p 1004, June 17, 1980.

Descriptors: *Patents, *Water treatment, *Water purification, *Reverse osmosis, Semipermeable membranes, Separation techniques, Pressure, Flow, Equipment.

A semipermeable membrane cartridge is reciprocated within a pressure resistant vessel to provide improved liquid flow and turbulence over the semipermeable membrane surfaces. The end of the semipermeable membrane cartridge exposed to the pressure of feed water introduced into one end of the pressure resistant vessel is adjusted or arranged to be of substantially the same effective cross sectional area as that of the end of the cartridge exposed to the pressure of brine being released from the other end of the pressure resistant vessel. This essentially balances the liquid pressure forces on the ends of the semipermeable membrane cartridge to provide improved conditions for reciprocation. (Sinha-OEIS)
W81-03384

WATER TREATMENT CHEMICAL DISPENSER WITH CONTROL TUBE,
Olin Corp., New Haven, CT. (Assignee).
A. G. Sangster, J. M. Casberg, and J. J. Tepas.
U.S. Patent No 4,208,376, 8 p, 6 Fig, 15 Ref; Official Gazette of the United States Patent Office, Vol 995, No 3, p 1030, June 17, 1980.

Descriptors: *Patents, *Water treatment, *Water quality control, *Equipment, Control systems, Application methods, Chemicals, Water levels.

An apparatus for dispensing and dissolving soluble water treatment materials is disclosed. The apparatus has an inlet, an outlet and a housing divided by a wall into an outlet chamber in fluid communication with the outlet and a dissolving chamber in communication with the inlet. A vertically adjustable control tube device for controlling the level of water in the dissolving chamber and an outlet valve device for maintaining the water level in the outlet chamber above the outlet are provided. A support device is provided to hold a number of cartridges with their lower ends immersed in the water in the dissolving chamber. A high water level malfunction shut-off valve with or without an indicator can be provided and the inlet flow can be controlled by perpendicular passageways with a rotary valve between them. The inlet may be in a wall of the outlet chamber and be isolated from the outlet chamber by an inlet valve mechanism leading to the dissolving chamber. (Sinha-OEIS)
W81-03385

HOUSEHOLD WATER FILTER,
Gelman Instrument Co., Ann Arbor, MI. (Assignee).
D. I. Hauk, G. Tanny, and W. G. Presswood.
U.S. Patent No 4,206,055, 5 p, 1 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 995, No 1, p 228-229, June 3, 1980.

Descriptors: *Patents, *Water treatment, *Filtration, Filters, *Domestic water, Membrane processes, Membranes, Valves, Backwashing.

The invention provides a water filter, particularly suited for household use, with valving which enables either a bypass mode or a filtering mode. During the filtering mode the water flows through a number of filtering layers one of which is a microporous membrane and during the bypass mode the water flows parallel to and against the membrane so as to clean the membrane of material accumulated during the filtering mode. (Sinha-OEIS)
W81-03474

THE SUCCESSFUL USE OF NON-CHROMATE COOLING WATER TREATMENTS,
R. J. Franco.
Industrial Water Engineering, Vol 17, No 5, p 14-18, September/October, 1980. 7 Fig, 1 Tab, 3 Ref.

Descriptors: *Cooling water, *Petroleum industry, *Chemical treatment, *Water treatment, Slime, Corrosion control, Scaling, Chlorination.

Non-chromate treatments have been used in recirculating cooling water systems throughout Europe for several years. Types of non-chromate programs used in 14 operating European refinery and petrochemical plants are summarized. The programs control corrosion, scale and microbiological growth. Corrosion inhibitors include polyphosphates, zinc, polyphosphate and zinc, and chromate. Dispersants and anti-scaling agents include phosphonates and phosphate esters, phosphonates and polymers, polyacrylates alone, tannins and natural polymers, and gluconate. Biocides include chlorine and biocides, chlorine alone, hypochlorite and biocides, and hypochlorite alone. Maintaining an adequate water velocity of at least 0.9 m/sec and ensuring that there is an adequate dosage of chemical treatment based on manufacturer's recommendations are two keys to a successful system. Also, sufficient hardness and alkalinity of the water must be ensured to reinforce the corrosion protective film. A minimum calcium hardness of 100 ppm and alkalinity of 50 ppm, both expressed as CaCO3, are desirable. Microbiological control should avoid slime fouling. Good chlorination is essential to the program's success. (Small-FRC)
W81-03506

WHY IS ROTUNDA STILL AN RO SUCCESS,
Rotunda West Water Treatment Plant, FL.
H. Sumrall, and B. Schomaker.
Water and Wastes Engineering, Vol 17, No 7, p 24-26, 28, July, 1980. 2 Fig, 2 Tab.

Descriptors: *Reverse osmosis, *Drinking water, *Florida, Performance evaluation, Membrane processes, *Water treatment facilities, Rotunda treatment plant.

The Rotunda, Florida, reverse osmosis treatment plant for drinking water successfully treats up to 500,000 gpd. Raw brackish water is piped from two wells, pH corrected, filtered, and stabilized. The reverse osmosis permeators operate at a 50% conversion, and the treated water then flows to the degasifier for CO2 and H2S reduction. After chlorination and storage, the water is pumped to potable use. The plant has produced potable water consistently for seven years. There are still 40 original permeators in use, and there has never been a failure due to degradation of the membrane. Each of the six permeator sub-assemblies consists of eleven 8-inch diameter fiberglass permeators with B-9 hollow fiber membranes. Good operating procedures, well-trained operators, and a defined maintenance schedule have contributed to the success of the plant. (Small-FRC)
W81-03530

ELECTRONIC INSTRUMENTATION ADDS DIMENSIONS TO METERING,
Rockwell International, Uniontown, PA. Municipal and Utility Div.
E. M. Weinberger.
Water and Sewage Works, Vol 127, No 8, p 46-47, 57, August, 1980. 4 Fig.

Descriptors: *Instrumentation, *Electronic equipment, Automatic control, Measurement, Water distribution, Management, Remote control, Equipment, *Water metering, Computers, Flow control, Demand, Prices, Control, Monitoring, *Water management.

Electronic instrumentation allows constant control in water management. Using both local and remote instrumentation, many functions are possible: monitoring and alarm systems; data transmission; control of chemical feed, main valves, and flow rate; and implementation of demand billing. (Cassar-FRC)
W81-03535

ASBESTOS-CEMENT PIPE IS NO DANGER IN CONNECTICUT,
Yale Univ., New Haven, CT. School of Medicine.
For primary bibliographic entry see Field 8F.
W81-03537

CROSS CONNECTION CONTROL, A MANAGEMENT DECISION,
Portland Water District, ME.
R. P. Grady.
Journal of the New England Water Works Association, Vol 94, No 4, p 309-315, 1980.

Descriptors: *Potable water, *Water management, *Wastewater pollution, *Water distribution, Contamination, Water pressure, Water conveyance, Leakage.

Water pressure, preventing inflow of waste water into potable water distribution systems, is often considered sufficient to prevent cross connection problems. However, in the case of water system shutdown, large fires, etc., the 'holes' in the distribution system may become bidirectional. The water manager must realize the possibility of cross connection occurring, the great danger it poses, and the necessity of doing something about this possibility, even though it is considered remote. The manager can be assisted in planning a cross connection prevention program by utilizing existing state program outlines and experiences from other local systems. Greatest attention must be paid to potentially high hazard situations. Finding funds to pursue cross connection prevention programs may be difficult, but their importance dictates that funds must be found. (Small-FRC)
W81-03540

WATER/WASTEWATER PROCESS CONTROL INSTRUMENTATION - PHYSICAL PARAMETERS AND THEIR MEASUREMENT,
For primary bibliographic entry see Field 7B.
W81-03562

SUBMERSIBLE PUMPS INSTALLED AT NEARBY SCENIC LAKE PROVIDED NEEDED WATER,
Moynihan (J. F.) and Associates, Lee, MA.
J. F. Moynihan.
Water/Engineering and Management, Vol 128, No 3, p 53, 81, 82, March, 1981.

Descriptors: *Reservoirs, *Pumps, *Droughts, *Water supply, Lakes, *Lenox, Massachusetts, Water distribution(Applied), Submersible pumps, Water storage.

The water supply of Lenox, Massachusetts, was critically low by August 1980 after a very dry summer. As an emergency measure, two electric submersible pumps were installed in the 50 ft deep Stockbridge Bowl, a nearby scenic lake with excellent water quality. Water was pumped from this lake to refill the town's two reservoirs starting in October 1980. It was expected that pumping would continue around the clock through April, lowering the lake level by 6 inches. When the reservoirs are refilled, the equipment will be left in the place for future emergenices. (Cassar-FRC)
W81-03582

CONTROL SETTLING TO OPTIMIZE WATER FILTRATION,
Metcalf and Eddy, Inc., NY.
G. P. Fulton.
Water/Engineering and Management, Vol 128, No 3, p 34, 39, 40, 101, March, 1981. 2 Fig, 2 Tab.

Descriptors: *Suspended solids, *Filtration, *Settling, *Evaluation, Water purification, *Water treatment, Coagulation, Flocculation, Color, Turbidity.

Recent advances in settling facilities used in conventional water treatment processes may be preferable to direct filtration with polymer coagulants for some water supplies containing color. Lamella separators have the best flow control features of all available settling devices. Pilot plant tests at New York's Croton supply indicated that the most economical combination for this water (14 mg per liter maximum solids generated in coagulation of raw water particulates) was 50% solids removal by settling and 40% removal by filtration. The evaluation method used here can determine the true capacity of both new treatment designs and existing water treatment systems. (Cassar-FRC)
W81-03584

THE AGE OF TRACE CONTAMINANTS,
Southern California Metropolitan Water District, LaVerne.
M. J. McGuire.
Water/Engineering and Management, Vol 128, No 2, p 12, 36, February, 1981.

Descriptors: *Drinking water, *Water quality, *Organic compounds, Trace levels, Economic aspects, Political aspects, Water treatment, Public health.

Although serious investigations into the potential health effects of trace amounts of various contaminants in water supplies began during the latter half of the 1970s, it was not until the development of the trihalomethane regulation in November, 1979, that the full impact of these concerns hit the water utility industry. Trace organics are the current center of this interest, but asbestos, low-level radiation, and viruses can be expected to attract greater attention in the near future. Utility managers are faced with health concerns about the presence of trace organics in drinking water, movements to cut government spending, and increased consumer demand for answers to complex technical problems related to drinking water quality. The major problem encountered in trying to assess the public health risks posed by different levels of trace organics is that little is actually known about the types of organics in drinking water. Practical problems associated with risk assessment include the imprecise and expensive nature of available analytical techniques, decisions based on grab samples rather than representative or composite sampling schemes, and a shortage of trained personnel to perform and interpret the results. Currently available treatment techniques which will remove all contaminating substances from water are expensive, as are such non-treatment options as effluent source control and changing the source of supply. Funding mechanisms to help water utilities meet the requirements of the Safe Drinking Water Act are under debate. Government grants, which have tended to undermine the financial and managerial independence needed by utilities, should be replaced by loan or guarantee options with only minimal and reasonable strings attached. (Carroll-FRC)
W81-03597

5G. Water Quality Control

LAKE TAHOE BASIN WATER QUALITY PLAN, FINAL PLAN.
California State Water Resources Control Board, Sacramento.
For primary bibliographic entry see Field 6E.
W81-03288

LAKE TAHOE BASIN WATER QUALITY PLAN, SUMMARY.
California State Water Resources Control Board, Sacramento.
For primary bibliographic entry see Field 6E.
W81-03289

CLOSURE TECHNIQUES AT A PETROLEUM LAND TREATMENT SITE,
J. E. Matthews, F. M. Pfeffer, and L. A. Weiner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 240-245. 2 Tab, 3 Ref.

Descriptors: *Land disposal, *Oil wastes, Hydrocarbons, Petroleum products, *Heavy metals, *Leaching, Pollutants, Soil contamination, Soil stability, Oil industry, Industrial wastes, Cyanide, Phenols, Monitoring.

The EPA has initiated a land treatment research program to determine the extent of migration of pollutants through the soil at closed land treatment facilities, and compare the efficacy of different closure techniques. Two projects have been selected. One study will compare four closure techniques over a three-year period - revegetating the site, closing the site like a landfill, removing the soil, and leaving the site as it is. Soil loss and the vertical transport of contaminants in the soil-pore water will be monitored. In the second study, three closed oily waste land treatment sites will be selected for unsaturated zone monitoring. Soil cores and lysimeters will be used to determine polynuclear aromatic compounds and heavy metals which may be found in petroleum refinery sludges, total cyanides and total phenols. When the results are compared with those obtained from studies on uncontaminated soil, it is expected that they will provide an indication as to whether 'acceptable' monitoring results as defined in the regulations are in fact acceptable from the standpoint of human health and the environment. (Brambley-SRC)
W81-03353

INORGANIC HAZARDOUS WASTE TREATMENT. II,
Little (Arthur D.), Inc., Cambridge, MA.
For primary bibliographic entry see Field 5D.
W81-03356

EVALUATION OF CATALYZED WET OXIDATION FOR TREATING HAZARDOUS WASTE,
IT Enviroscience, Knoxville, TN.
R. A. Miller, R. D. Fox, and D. M. Pitts.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 272-276.

Descriptors: *Wastewater treatment, *Hazardous materials, *Landfills, *Oxidation, Catalysts, Organic compounds, Pesticides, Phenols, Hydrocarbons, Aromatic compounds, Phthalates, Economics.

This paper describes the evaluation of a unique, patented catalyst system for treating toxic and hazardous waste from active and abandoned chemical landfills. The catalyst system uses an acidic solution of bromide, nitrate, and manganese ions to destroy organic residues and aqueous wastes. Fifteen compounds (including halogenated hydrocarbons, pesticides, phenols, phthalates, polynuclear aromatics and others) were selected to represent the wide variety of wastes which could be found in a chemical landfill. Batch oxidations of these compounds were performed in a 1-liter stirred autocalve to determine the destruction rate and by-products of the process. While detailed analysis of the results has not been completed, sufficient data are available to provide insight into effectiveness and applicability of the process. The catalyst has the advantages of being homogeneous, and effective at low temperatures, 165-200C, and low operating pressures. Preliminary designs of treatment processes have been made based on the demonstrated destruction rates. Cost estimates for these processes are provided to permit assessment of the technology for treating hazardous wastes. (Brambley-SRC)
W81-03357

TOP SEALING TO MINIMIZE LEACHATE GENERATION - STATUS REPORT,
SMC-Martin, King of Prussia, PA.
G. H. Emrich, and W. W. Beck, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings

of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 291-297. 5 Fig, 1 Ref.

Descriptors: *Water pollution control, *Water pollution prevention, *Leachates, Impervious membranes, Plastics, *Landfills, Groundwater pollution, Plumes, Revegetation.

Remedial actions consisting of regrading and the placement of a 20 mil PVC membrane seal over a 10 ha (25-acre) landfill, followed by 18 in of soil cover and revegetation were conducted at Windham, Connecticut Landfill during the fall of 1979. A bimonthly monitoring program is being conducted to establish the effectiveness of the top seal for mitigation of the existing ground-water pollution. Investigation of the structural integrity of the top seal were conducted in April and May of 1980. These investigations indicated a minimal number of small punctures occurred in the top seal membrane. Spring recharge was effectively intercepted by the membrane and diverted from the landfill. Pan lysimeters installed below the membrane confirmed the effectiveness of the membrane for intercepting recharge from precipitation. Water samples from monitoring wells within the landfill and surrounding it indicate that water quality is improving and the plume of contamination is receding toward the landfill. It is concluded that it is possible to place a 20 mil PVC top seal over a 10 ha landfill as a remedial measure to mitigate contamination of ground water.
W81-03359

REMEDIAL ACTIONS AT UNCONTROLLED HAZARDOUS WASTE SITES,
SCS Engineers, Covington, KY.
N. S. Neely, J. J. Walsh, D. P. Gillespie, and F. J. Schauf.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-80-002b, March, 1981, p 312-319. 8 Tab, 9 Ref.

Descriptors: *Land disposal, *Water pollution sources, *Waste disposal, Pollutants, *Hazardous materials, Remedies, Landfills, Incineration, Injection wells, Groundwater pollution, Air pollution, Food chains, Costs, Heavy metals, Organic wastes, Inorganic compounds, Solvents, Septic wastewater.

Nine sites of 169 sites identified were studied in detail to document typical pollution problems and remedial actions at uncontrolled waste sites. The sites included landfills, drum storage sites, injection wells, and incinerators. These sites included two remedied and seven improved sites, which had contaminated ground and surface waters, soil, air, and the food chain. The waste types causing contamination included mercury, arsenic, solvents, oil, tire wastes, inorganic and organic waste, and septic waste. The technology employed consisted of containment, removal of waste for incineration or secure burial, and institution of surface water and/or ground water controls. Cost was found to be the prime determinant of the type of technology applied. Costs for the implemented remedial actions ranged from $250,000 to more than $7,000,000. Remedial actions were not always effective for lack of sufficient funds and/or improper selection of corrective technologies. (Brambley-SRC)
W81-03361

ANTI-POLLUTION BOOM,
British Petroleum Co. Ltd., Sunbury-on-Thames (England). (Assignee).
M. G. Webb.
U.S. Patent No 4,207,191, 6 p, 5 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 995, No 2, p 620, June 10, 1980.

Descriptors: *Patents, *Water pollution control, Water quality control, *Oil pollution, Oil spills, Barriers, Floating, Containment, Oil booms.

An anti-pollution barrier is comprised of a buoyant air tube, a ballast water tube and a membrane. Sections of reduced diameter in the air tube provide weirs over which surface oil and water spill. An oil and water discharge tube is provided which may be inside or outside the water tube. If inside, then one end of the membrane is connected to the air tube and the other end to the ballast tube to form a gallery for reception of the overspill. If outside, then one end of the membrane is connected to the air tube and the other end to the discharge tube to form the gallery. Pumps may be provided in the discharge tube to remove overspill from the gallery. (Sinha-OEIS)
W81-03374

DRILL CUTTINGS DISPOSAL SYSTEM WITH GOOD ENVIRONMENTAL AND ECOLOGICAL PROPERTIES,
Dresser Industries, Inc., Dallas, TX. (Assignee).
T. E. Sample, Jr.
U.S. Patent No 4,208,285, 6 p, 5 Fig, 2 Tab, 6 Ref; Official Gazette of the United States Patent Office, Vol 995, No 3, p 1003, June 17, 1980.

Descriptors: *Patents, *Water quality control, *Water pollution control, *Oil pollution, Disposal, Distillation, Drilling, Equipment, Offshore platforms, Drill cuttings, Hydrocarbons.

An object of this invention is to provide a safe means of treating oil or hydrocarbon coated or impregnated drill cuttings for disposal either on land or in a body of water, without incurring unacceptable environmental contamination or ecological upset. The invention comprises a unitized continuous on-site apparatus employing the principles of steam-stripping and non-oxidative thermal distillation to effect the simultaneous removal of hydrocarbons and water from the cuttings, leaving them in a condition sufficiently pollution-free as to be fit for direct disposal in waters adjacent to an offshore drilling platform. They can also be used as a landfill in the vicinity of a land-based operation. In addition, the hydrocarbons and water removed from the cuttings are collected in a state suitable for subsequent use as components of the drilling fluid system. (Sinha-OEIS)
W81-03381

OIL SPILL SKIMMER,
E. F. Brieck.
U.S. Patent No 4,208,287, 6 p, 7 Fig, 18 Ref; Official Gazette of the United States Patent Office, Vol 995, No 3, p 1003-1004, June 17, 1980.

Descriptors: *Patents, *Oil pollution, *Water quality control, Skimming, Separation techniques, Floating, Boats, Equipment, Oil recovery.

A floating vessel is provided with an oil-receiving tank, the front of which has a horizontal sill near the top of the tank. The tank is provided with a chamber for water ballast, to which water is added or from which it is withdrawn to submerge the vessel far enough for the sill to be at oil-skimming level. Attached to opposite sides of the front of the vessel are the rear ends of forwardly diverging floating booms, the front ends of which are connected to boats that pull the booms and vessel through the water to gather oil between the booms and direct it over the sill into the tank, from which oil is pumped to a holding receptacle. (Sinha-OEIS)
W81-03382

PROCESS FOR ALKALINE SCALING,
CIBA-GEIGY Ltd., London (England).
T. D. Hodgson, K. W. Carley-Macauly, and S. Smith.
U.S. Patent No 4,204,953, 4 p, 7 Ref; Official Gazette of the United States Patent Office, Vol 994, No 4, p 1361, May 27, 1980.

Descriptors: *Patents, *Water treatment, *Scaling, Saline water, *Desalination apparatus, *Neutralization, Bicarbonates, Inhibitors, Heat exchangers, Additives, Water quality control.

A method of inhibiting the deposition of scale from saline water, having bicarbonate alkalinity, onto the heat exchange surfaces of a saline water evaporation plant comprises adding a mineral acid to the saline water to neutralize part but not all of the bicarbonate alkalinity and adding a scale inhibiting additive to the partly neutralized saline water, the amount of acid adding being such that the pH of the saline water which is flowing within the plant is not reduced below 7.5. (Sinha-OEIS)
W81-03404

STRATEGIES TO CONTROL NONPOINT SOURCE WATER POLLUTION, BY J. JEFFREY PEIRCE,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr.
Water Resources Bulletin, Vol 17, No 1, p 144, February, 1981. 1 Ref. OWRT A-048-NJ(9).

Descriptors: *Nonpoint pollution sources, *Control systems, Flood control, Pollution control, Water control, Water pollution sources, Pollution sources, *Water pollution control.

Efforts to control nonpoint source pollution are briefly cited. In some states the retention of particulate runoff pollution has been obtained along with the measures taken to guard against damage from storm water and its potential flooding. In some cases the flood basins have only been expanded in capacity by about 15% to cover this additional problem. It is stressed that storm water management and the control of nonpoint source pollution of small streams and rivers is very much a matter of local, regional and community interest and that dependence on some federal agency is not to be sought. (Baker-FRC)
W81-03438

CHEMICALS AND ALLIED PRODUCTS,
Union Carbide Corp., South Charleston, WV.
For primary bibliographic entry see Field 5D.
W81-03482

OIL DISPERSANTS IN CANADIAN SEAS - RECOMMENDATIONS FROM A RESEARCH APPRAISAL,
Guelph Univ., (Ontario). Dept. of Zoology.
J. B. Sprague, J. H. Vandermeulen, and P. G. Wells.
Marine Pollution Bulletin, Vol 12, No 2, p 45-46, February, 1981. 10 Ref.

Descriptors: *Research needs, *Dispersants, *Oil spills, Oil pollution, Marine environment, Water pollution effects, Water pollution control, Cleanup operations, Canada.

Recommendations are made concerning research on oil spills, relevant physical-chemical factors, effects of chemically dispersed oil on marine organisms, and strategies to minimize the effects of oil spills in Canadian seas. Better use of spills-of-opportunity is recommended. When a spill such as Ixtoc in the Gulf of Mexico occurs, scientists should have a well-organized, pre-funded study planned to increase knowledge of oil spill behavior. Experimental oil spills are also recommended, as some spills of 1 to 15 cu m are essential to improve the understanding of spill behavior and effects. Other research topics suggested include: the behavior of deep-sea blowouts, the fate of chemically dispersed oil, activities of oil degrading bacteria in cold waters, and the effects of spilled oil on marine organisms including birds. Cleanup and control strategies to minimize the effects of spills are needed. Special strategies need to be developed for the protection of selected habitats such as salt marshes, the protection of birds, and the protection of fish spawning grounds. (Small-FRC)
W81-03509

INDUSTRIAL OIL SEPARATION.

Effluent and Water Treatment Journal, Vol 20, No 11, p 554-555, November, 1980. 2 Fig.

Descriptors: *Oil, *Water quality control, Separation techniques, *Oil spills, Industrial wastes, Equipment, Skimming, *Oil recovery.

A system is presented which has been designed to handle a wide variety of industrial oil separation problems on a continuous and unmanned basis. The system will remove oil from water in one operation, not merely transfer a mix of oil and water for further separation. The system is designated the Kebab industrial skimmer, and its development was based on years of working with offshore and coastal oil pollution. The skimmer uses the oleophilic disk and scraper principle. Design criteria in planning the equipment were: high oil pick-up, low water pick-up, continuous unattended operation, minimum maintenance, modular fabrication, simple installation, and tolerance to varying conditions. The modules have been successfully employed in refineries, power stations, steelworks and chemical companies, where they serve not only to prevent pollution, but also to recover a usable product. (Baker-FRC)
W81-03539

MICROBIAL SAMPLING VARIABLES AND RECREATIONAL WATER QUALITY STANDARDS,
Illinois Univ. at the Medical Center, Chicago. School of Public Health.
G. R. Brenniman, S. H. Rosenberg, and R. L. Northrop.
American Journal of Public Health, Vol 71, No 3, p 283-289, March, 1981. 6 Tab, 31 Ref.

Descriptors: *Public waters, *Beaches, *Microorganisms, Bacteria, Staphylococcus, Streptococcus, Clostridium, Coliforms, *Lake Erie, Recreational facilities, Swimming.

This study evaluates the concentration of several microbiological indicator organisms in relation to day, time, and location of collection at two beaches on Lake Erie, in the Cleveland, Ohio metropolitan area. One beach, Edgewater, has 250 meters of shoreline and is situated near two major point sources of organic and inorganic pollution that contribute high concentrations of fecal coliforms at the beach. Headlands State Park is the other beach studied, and has a 600 meter shoreline with monthly geometric mean fecal coliform concentrations well below the state standard. It was concluded from the study that in order to investigate health effects of recreational water as related to some microbiological variables, one needs to know the specific time of day and day of the weekend that an individual was exposed. Differences in bacteriological indicator levels between sampling time of day and day of weekend can probably be attributed to such variables as wind direction, wind speed, wave height, precipitation, water temperature and waste sources. No significant differences at various locations in the bathing area were noted for the indicator variables considered in this study. (Baker-FRC)
W81-03595

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

PLANNING GROUND WATER SUPPLY SYSTEMS FOR URBAN GROWTH: A MULTILEVEL PERSPECTIVE,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
J. W. Delleur, S. A. Dendrou, and G. V. Loganathan.
In: IFAC Symposium on Water and Related Land Resource Systems, Cleveland, Ohio, 1980. p 295-305, 1981, 6 Fig, 7 Tab, 17 Ref. Pergamon Press, New York. OWRT-A-057-IND(3) and OWRT-B-083-IND(13).

Descriptors: *Urban development, *Water supply, *Groundwater, *Finite element method, Optimization, Land use, Municipal waters.

A methodology has been developed to include effectively water supply from groundwater in urban planning. The model LANDUSE for prediction of urban development and water demand is linked to the model WATSUP, an optimization oriented finite element based water supply model for prediction and optimization of future water supply configurations. The nonlinearity of the objective function due to nonlinear head losses has been circumvented by means of empirical relationships for head losses and design criteria for pump and pipe sizes. The requirement that some decision variables such as the number of wells, equalizing reservoirs, etc. be integer variables leads to a mixed integer programming formulation. A two level coordination scheme is used in locating an optimal number of facilities such that cost is minimized and a safe exploitation of aquifer in the future is guaranteed. The methodology is applied to an actual situation in West Lafayette, Indiana. W81-03283

'HYDUR' HYDROPOWER ANALYSIS USING STREAMFLOW DURATION PROCEDURES.
Hydrologic Engineering Center, Davis, CA.
Generalized Computer Program, Users Manual, August, 1980. 144 p, 4 Fig, 3 Tab, 6 Ref.

Descriptors: *Flow duration, *Hydroelectric plants, *Computer programs, *Streamflow, *Cost-benefit analysis, Construction costs, Operating costs, Project planning, Electric power, Powerplants, Capacity.

This computer program will analyze streamflow duration data and calculate estimates of power and energy potential for both run of river and storage type projects, and reconnaissance level benefits and costs at proposed hydropower installations. Options are available that permit the user to specify the desired capacity of the plant, or allow the program to select the optimum capacity based on a user supplied criterion. Construction, equipment, investment, replacement, operation and maintenance costs are estimated from the installed capacity, assumed operating head, and other pertinent information about the dam site. The criterion used to select the installed capacity of the plant can be based on maximizing a combination of costs, benefits, capacity or energy generation. The technical procedures for estimating capacity and average annual energy are good for run of river projects, but are less exact for storage projects because of generalized reshaping techniques used to adjust the flow-duration curve and estimates of average operating head. The procedures for estimating costs were based on median costs of recent projects and were not intended for accurate cost estimates of actual projects. (Moore-SRC)
W81-03332

USING ENVIRONMENTAL BELIEFS AND PERCEPTIONS TO PREDICT TRADE-OFFS AND CHOICES AMONG WATER QUALITY PLAN ALTERNATIVES,
State Univ. of New York at Buffalo. Environmental Studies Center.
L. W. Milbrath.
Socio-Economic Planning Sciences, Vol 14, No 3, p 129-136, 1980. 5 Tab, 4 Ref.

Descriptors: *Surveys, *Public participation, *Water quality standards, Water quality management, Water quality control, Public policy, Social participation, Planning.

Deficiencies encountered in citizen representation in environmental planning are discussed. The greatest deficiency is that citizen committees and even hearing are by no means representative. A second major deficiency of traditional methods of citizen participation is that it is extremely difficult to sustain interest in active participation over a several month period. The effect of these problems in the Niagara Frontier region is noted. During the summer of 1976 a random sample of 1021 members of the public and leaders of the Niagara Frontier region was interviewed to provide information which would serve as input to a '208' water quality plan being developed for that area. After an 18 month interval, these persons were interviewed a second time on their beliefs and on their choice among plan alternatives. The results of these two surveys suggest that for surveys to be successful they must have the backing and support of the planners, or they must be backed by an active and visible citizen's movement to insist that leaders attend to the survey findings. (Baker-FRC)
W81-03518

DESIGN TOOL AIDS GROUNDWATER MANAGEMENT,
Science and Education Administration, Fresno, CA. Water Management Research.
H. I. Nightingale.
Water and Sewage Works, Vol 127, No 6, p 56-57, 91, 92, June, 1980. 2 Fig, 1 Tab.

Descriptors: *Groundwater management, *Administrative decisions, Hydrogeology, *Water quality, Hydrology, Groundwater hydrology, Groundwater development, Frequency analysis, Frequency distribution, Mathematical studies, *Specific conductivity.

A graph of the probability density or specific electrical conductivity or ion-concentration parameter will serve as a tool to help decision makers not trained in hydrology or geohydrochemistry make the correct decisions regarding groundwater chemical quality. The empirical concentration-probability distribution curve provides information such as an estimate of the population median, an estimation of population variance, the general range of expected concentration values, and the probability of field concentration values being equal or less than a given concentration value. The applicability of this statistical technique is illustrated for a field situation consisting of an agricultural-urban area of about 200,000 people whose domestic water source is groundwater. Recharge areas are undergoing a land-use change from irrigated agriculture to rural residential homes. (Baker-FRC)
W81-03536

FACING A MAJOR DISASTER WITH CALM ASSURANCE,
Southern California Metropolitan Water District, Los Angeles.
P. R. Singer, and C. F. Voyles.
Water and Sewage Works, Vol 127, No 6, p 58, 60, 74, June, 1980. 5 Fig, 1 Tab.

Descriptors: *Earthquakes, *Disasters, *Administrative decisions, Earthquake engineering, Earth pressure, Seismic waves, Engineering, Decision making, Policy making, Operating policies.

Response after an earthquake in Southern California, which affected the Metropolitan Water District of that area, is reviewed. Initial reports were all favorable. However, due to lack of adequate communication between the Metropolitan agency and other agencies involved, there were some problems in the aftermath of the quake. An earthquake committee was established to prepare seismic investigations of all facilities, recommendations for improvements, and an earthquake emergency response plan. One major facet of the plan is that operational changes required to prevent serious danger to life or extensive property damage can be undertaken at the discretion of personnel at the affected facility without waiting for higher-level approval. Workshops were held in each geographic area where the danger exists to discuss the plan. Repairs that were needed have been somewhat innovative in many instances. While this emergency response plan was drawn primarily for earthquakes, it is adaptable to other system disruptions such as electric outages, major breaks in a pipeline, sabotage, communication disruption, or weather related emergencies. (Baker-FRC)
W81-03557

6B. Evaluation Process

A WATER SUPPLY COST MODEL INCORPORATING SPATIAL VARIABLES,
Environmental Protection Agency, Cincinnati, OH. Office of Research and Development.
R. M. Clark, and R. G. Stevie.
Land Economics, Vol 57, No 1, p 18-32, February, 1981. 3 Fig, 5 Tab, 14 Ref.

Descriptors: *Costs, *Water supply, Mathematical modeling, Public utilities, *Water distribution, Water costs, Population, Optimization, Utilities, Economies of scale, Economics, Planning.

An analytical model is developed to represent the cost of distributing water supply services in a single urban area. It includes the relationship of transmission costs to the problem of serving spatially distributed demand. It is possible to find a point at which the partial differential of the average cost function with respect to distance is zero, yielding a system size for minimum cost. Although the per capita consumption and absolute levels of population density have little effect on least cost system size, the minimum cost solution is very sensitive to population distribution. These insights can be used in planning water systems, especially regarding efficient utility size and alternatives for outlying areas. (Cassar-FRC)
W81-03414

WORKBOOK EXAMPLE ILLUSTRATES ELECTRICAL SAVINGS,
D. Brailey, and A. Jacobs.
Water and Sewage Works, Vol 127, No 5, p 46-47, 68, 69, 74, May, 1980. 5 Fig, 8 Tab.

Descriptors: *Electric power rates, *Energy conservation, *Water treatment facilities, Electric power demand, Water demand, User charges.

Energy usages involved in the acquisition, treatment and distribution of water supplies are described. Electric rate structures are composed of a mix of connection, demand, reactive-demand, standby, basic energy, time-of-day, and fuel-adjustment charges. The connection charge is usually a fixed charge not dependent upon usage. Demand charges are based on the maximum average resistive electric power demand for a given interval during a billing period. Reactive demand charges are based on the average power factor of an electrical system during a billing period. Basic energy-charge savings can be realized in the area of high-efficiency motors, improved pump efficiency, increased system storage, reduced unaccounted-for water, checked distribution system valves, and cleaned and lined pipes. One method to reduce chemical-energy needs is to control coagulation-chemical dosage. If coagulation control were applied to cut average alum dosage from 20 mg/liter to 15 mg/liter, a yearly savings of about $6,000 could be realized for a 10-MGD plant. (Baker-FRC)
W81-03528

IRRIGATION BENEFITS,
Department of Agriculture, Ashburton (New Zealand). Winchmore Irrigation Research Station.
D. Rickard.
New Zealand Journal of Agriculture, Vol 141, No 4, p 63-64, November, 1980. 1 Tab.

Descriptors: *Irrigation, *Soil types, *Climates, *Crop response, Sugar beets, Energy sources, Fuel, Direct irrigation, Drilling, Plant growth, *New Zealand.

This article discusses the influence of soil type and climate on the response to irrigation, the growing of crops for liquid fuel production, and direct drilling and irrigation. While much work has been done concerning soil type and climate it will be a few more years until an overview is gained of just how soil type and climate affect the response to irrigation. Even so, percentage increases resulting from irrigation of crop land have reached as high as 150% in some crops. In the area of growing crops for energy, some evidence suggests that fodder beets give a higher sugar yield than Amon sugar beets, and work on the agronomy of fodder and sugar beet crops for ethanol is continuing. The effects of times of sowing and of harvesting, the use of different cultivars, weed and pest control, and fertilizers are under study. If this is to become a significant crop for New Zealand, the use of irrigation will be mandatory. The use of direct drilling as opposed to the conventional cultivation system to obtain a crop is discussed. (Baker-FRC)
W81-03529

RIVER BASIN SIMULATION MODELS: GUIDELINES FOR THEIR USE IN WATER RESOURCES PLANNING,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
K. M. Strzepek, and D. H. Marks.
Water Resources Bulletin, Vol 17, No 1, p 10-15, February, 1981. 1 Fig, 9 Ref.

Descriptors: *Simulation analysis, *River basin development, *Water resource development, Planning, Synthetic hydrology, Hydrology, Vardar River, *Yugoslavia, Axios River, *Greece, Reservoirs, Decision making, Irrigation.

Simulation models have been widely used to determine the performance of a river basin. However, projects including more than 50 or 100 alternative reservoirs, irrigation areas, and other components are too complicated to use a simulation model effectively. A model was applied to a complex river basin project, the Vardar/Axios River Basin in Yugoslavia/Greece. The result is a set of general guidelines. Presimulation steps are: analyze decision making process, decompose the basin into its hydrologically independent parts, and perform preliminary analysis (in this case a 'routing' model). Simulation procedures are: give priority to each of the system purposes, determine the response of each component to changes in design and operational variables, discuss results with decision makers, make additional runs using decision maker's input, present best alternative, and run a sensitivity analysis on the chosen configuration. (Cassar-FRC)
W81-03552

FOCUSED AND DIFFUSE PATTERNS OF AQUATIC RECREATION BEHAVIOR,
Washington Univ., Seattle. Coll. of Forest Resources.
D. R. Field, and N. H. Cheek, Jr.
Water Resources Bulletin, Vol 17, No 1, p 16-22, February, 1981. 8 Tab, 20 Ref.

Descriptors: *Recreation facilities, *Psychological aspects, *Water policy, Surveys, Social needs, Planning, Swimming, Fishing, Social aspects, Nonconsumptive use, Multiple-purpose projects, Management, Water demand, Washington.

Patterns of water recreation behavior by focused (all outdoor recreation activities based on water) and diffuse (outdoor recreation activities both water and non-water) households were studied by questionnaires in the State of Washington in the summer of 1977. The more focused the household, the smaller the total number of water based activities and the greater the likelihood of fishing and boating at natural aquatic sites. Conversely, diffuse households were more likely to participate in a larger number of water based activities at artificial pools and impoundments, swimming being the predominant activity. These results show the complexity of planning water recreation facilities to serve the diverse needs of a population. Fishermen-boaters often expect different conditions than swimmer-fishermen. If behavioral outcomes are known, designing and managing water recreation sites may be more effective. (Cassar-FRC)
W81-03553

PRELIMINARY DESIGN AND COST ESTIMATING FOR RESERVOIR PROJECTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
T. M. Walski, and A. Pelliccia.
Water Resources Bulletin, Vol 17, No 1, p 49-56, February, 1981. 4 Tab, 12 Ref.

Descriptors: *Reservoir design, *Computer programs, *Cost analysis, Estimated costs, Planning, Model studies, Construction costs, Engineers estimates, Dams.

The MAPS (Methodology for Areawide Planning Studies) computer program, with revised reservoir module, was used to quickly estimate costs for reservoir projects with reasonable accuracy. It divides the costs into major items and calculates the cost of each item using cost curves and multiplying quantity times unit price. The design parameters may be varied and repeat runs made with little extra effort. The cost estimates produced by the model were verified using 6 reservoir projects varying in capacity from 2,300 to 775,000 acre-feet. Percent difference between actual and MAPS estimated costs averaged 8% and ranged from -13.33% to 17.20%. (Cassar-FRC)
W81-03555

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

SUBSTITUTION POSSIBILITIES FOR WATER INPUTS IN SELECTED INDUSTRIES,
EG and G Environmental Consultants, Watham, MA.
F. G. Babin, C. E. Willis, P. G. Allen, and A. S. Vlachou.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209090, Price codes: A07 in paper copy, A01 in microfiche. Completion Report, October, 1980. Massachusetts Water Resources Research Center, University of Massachusetts, Amherst, Publication No 121. 114 p, 3 Fig, 7 Tab, 84 Ref, 6 Append. OWRT-A-120-MASS(1), 14-34-0001-9023.

Descriptors: *Industrial water, *Water use, *Water costs, *Economic aspects, *Estimating, Water demand, Industrial production, Water supply, Water, Cooling water, Decision mailing, Evaluation, Industrial development, Resource development, Costs, User charges, Industrial plants, Water rates, Consumptive use, Water use efficiency.

This study sought to estimate the responsiveness of industrial water demand to changes in its price and the prices of other factors of production. Measures of these price elasticity values should be of value in assisting decision makers in using water price as a policy tool in conservation/development of water resources. By estimating elasticities of substitution among water, capital, and two types of labor, the relative use of substitutability of these inputs within different industries can be better understood. Empirical estimates showed water and both production and non-production labor to be substitutes in production, but water and capital were found to be compliments for several selected two-digit industries. One implication was that efforts to induce capital investment will, given capital-water complementarity, generally lead to increased industrial water demands, a result which may be counter to a region's efforts to curtail such demands. From the water conservation side, systematic efforts to reduce conservation through higher water prices will reduce capital equipment investment, but cause increased demands for labor. However, estimates suggested that capital expenditures reduction would probably be small. (Zielinski-IPA)
W81-03255

WORKBOOK EXAMPLE ILLUSTRATES ELECTRICAL SAVINGS,
For primary bibliographic entry see Field 6B.
W81-03528

WASTEWATER PLANTS SHOULD RECOVER COSTS FOR TREATING INDUSTRY DISCHARGES,
Environmental Protection Agency, Washington, DC.
E. C. Beck.
Water and Sewage Works, Vol 127, No 5, p 8, May, 1980.

Descriptors: *Wastewater facilities, *Economic aspects, Public utility districts, Industrial wastewater, Industrial wastes, Subsidies, Governments, Administrative agencies, *Wastewater treatment.

The industrial cost recovery (ICR) program of eliminating preferential subsidy to industries discharging into publicly owned wastewater treatment systems is discussed. Because each public system is different, it is difficult to generalize about the uniform application or removal of ICR systems across the nation. EPA is attempting to gain more flexibility in consideration of the individual circumstances of the grantee and its industrial users. The possibility of an increase in the Gpd flow exemption rate is considered, as it would lessen the administrative burden on certain grantees and would benefit many more small firms that are not able to finance self-treatment facilities. Another possible step would be to exempt grantees demonstrating existing funding mechanisms that provide for future capital expenditures. Exempted grantees would have to show that elimination of ICR would not produce a disproportionate share of current and future treatment system costs being imposed on residential users. Another option is to permit grantees to avoid ICR requirements if industrial capacity financing is not sought from the federal government. (Baker-FRC)
W81-03538

STATE FINANCING OF WATER PROJECTS: THE UTAH EXPERIENCE,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
D. H. Hoggan, K. R. Kimball, and J. M. Bagley.
Water Resources Bulletin, Vol 17, No 1, p 1-9, February, 1981. 7 Ref.

Descriptors: *Financing, *State governments, *Water resources development, Water management(Applied), Water policy, *Utah, Cost-benefit analysis, Urbanization, Loans, Energy development, Water law, Economics, Capital, Government finance, Economic feasibility, Project feasibility, Political aspects, Irrigation, Agriculture, Institutions.

Utah's present state water management policies, traditionally oriented toward agriculture, should be carefully reevaluated as the area experiences urbanization and large scale energy development. There are three financing programs at present. The Revolving Construction Fund (1947) provides money for water projects which are then bought from the state by private groups, such as irrigation cooperatives and water companies. The Cities Water Loan Fund (1975) helps finance improvements in water systems for communities faced with exploding populations. The Water Resources Conservation and Development Fund (1978) lends money for large projects. Unlike the other funds, this one charges interest on its loans. The author suggests that rigorous cost-benefit analysis be applied to state-financed projects to assure the even distribution of benefits to all segments of Utah's population. (Cassar-FRC)
W81-03546

ACCOUNTING AND REPAYMENT PROVISIONS OF THE PICK-SLOAN MISSOURI BASIN PROGRAM,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
B. B. Johnson.
Water Resources Bulletin, Vol 17, No 1, p 129-132, February, 1981. 7 Ref.

Descriptors: *Accounting, *Repayment contracts, *Cost repayment, Financing, Pick-Sloan program, Water policy, Legal aspects, *Water users, Government supports, Loans, Payment, Water projects, Capital, Water and Power Resources Service, Irrigation, Hydroelectric power, *Missouri River basin.

The accounting and repayment practices used by the Water and Power Resources Service greatly distort the money ultimately repaid to the Federal Treasury. The Pick-Sloan Missouri Basin program, analyzed as an example, repays only $1 of every $2 of public subsidy for hydroelectric power. Interest charges for the loan are 3% for the power portion and none for the irrigation portion. With a more conventional 9% interest, the annual repayment would be 3 times the present figure. The irrigators repay approximately 3 cents for each $1 of public expenditure. These accounting procedures should be restructured as soon as possible to insure fair allocation of monies, encourage energy conservation, and respond to public pressure for fiscal accountability. (Cassar-FRC)
W81-03547

ESTIMATING THE UNACCOUNTED-FOR WATER IN A DISTRIBUTION SYSTEM,
Hackensack Water Co., Weehawken, NJ.
P. Tao.
Water and Sewage Works, Vol 127, No 5, p 52-54, 72, May, 1980. 3 Fig, 1 Tab, 2 Ref.

Descriptors: *Water loss, *Estimating, Water management, Water measurement, *Water metering, *Water distribution, Water consumption, Water conservation.

Unaccounted-for water is defined as the difference between the amount pumped into the distribution system and the amount of water registered by all the customers' meters. The loss of revenue can be overcome through the use of weighted averages. Unaccounted-for water affects the development and operation of the entire system, as it is a waste of resources and energy. On the average, meter readings lag behind consumption by 0.5 or 1.5 months, depending on whether a meter is read once a month or once a quarter, respectively. The weighted average technique is based on the assumptions that meter readings take place each day of the month, that each day the same number of meters are read, and that consumption of water by either monthly or quarterly customers in a given month is proportional to the total amount of water pumped into the distribution system. A more accurate estimation of unaccounted-for water will lead to a better understanding of the causative factors of water losses and possible remedies. (Baker-FRC)
W81-03564

COOPERATIVE VALUE ENGINEERING APPROACH DERIVES SUBSTANTIAL SAVINGS,
R. B. Williams, M. T. Stendahl, W. F. Wolfson, and R. C. Miller.
Water and Sewage Works, Vol 127, No 5, p 48, 50, 64, 65, May, 1980. 2 Fig, 6 Tab.

Descriptors: *Water treatment facilities, *Economic efficiency, Economic aspects, Economic evaluation, Economic feasibility, Economic justification, Performance evaluation, Operating costs, Cost effectiveness.

Regulations of the Environmental Protection Agency require a value engineering (VE) analysis of all projects having an estimated construction cost of $10 billion or more. These can be extremely productive, since VE is a cooperative effort between the owner, the design engineer, and the VE teams, and the analyses are conducted in a positive environment. The VE workshop is carried out to identify alternative methods for achieving a specified function by equal or more reliable methods at lower capital and operating costs. One such workshop conducted in Santa Ana, California on the Aliso Water Management Agency's coastal treatment plant is discussed as an example. This particular VE report addressed two different treatment plant configurations and seven process functions, including the aeration method and configuration, the blower apparatus and appurtenances, the building and grounds, the clarification facilities, the dissolved air flotation system, the headworks and the sludge handling and piping systems. (Baker-FRC)
W81-03586

WATER RATE SURVEY IN MICHIGAN,
V. W. Langworthy.
Water/Engineering and Management, Vol 128, No 2, p 40, February, 1981. 1 Tab.

Descriptors: *Water rates, *Michigan, Surveys, Municipal water.

The Michigan Section, American Water Works Association, Community Relations committee has completed a survey of water rates charged in the State. The survey report contains information on rates charged by 316 communities in the State. Data are reported in a manner which permits comparison of the rate structures between communities. Such comparisons demonstrate the existence of a wide variation in the charges made by utilities in different communities for the same volume of water sold. Among similarly-sized communities, the rates charged for 1,000 gallons of water may be over 100 times higher in one community than in another. The data suggest that water rates are frequently based on what the traffic will bear rather than on an assessment of the real costs of producing and delivering the product. (Carroll-FRC)
W81-03598

6D. Water Demand

SUMMARY OF TECHNICAL CONCLUSIONS TO 1979.
Melbourne and Metropolitan Board of Works (Australia).
Water Supply Catchment Hydrology Research Report No MMBW-W-0012, 1980. 41 p, 13 Fig, 2 Tab.

Descriptors: *Forest watersheds, *Water quality, *Water supply, Streamflow forecasting, *Catchment areas, Research priorities, Forecasting, Catchment basins, Basins, River basins, Watersheds, Research facilities, Technology, Water analysis, Forecasting, Water quality control, Water policy, Lumber industry, Pollution load, Water pollution sources, Road construction, *Water management, *Melbourne, Australia.

The overall objective of the Board of Works for its catchment hydrology research program is to use the scientific results generated to assist in defining an efficient water supply catchment management policy. This report summarizes technical conclusions to 1979, the bases for which are given in technical reports and papers published under the program. The research methods used include historical evidence and scientific literature reviews; catchment experiments; research concerning specific components of forest water consumption; and methods development to extrapolate research results to larger water supply catchments. The report describes studies in catchment experiments, the effect of well-managed roading and timber harvesting on water quality, streamflow yield, and theoretical extrapolation to a large water supply catchment. Research has shown that stricter prescriptions for logging roads, governing intensity, drainage and maintenance, are essential to good water quality. Other conclusions reached are: timber harvesting without appropriate catchment protection prescriptions will have a major water quality impact of serious consequence to water supply; harvesting must be excluded from areas of 25-degree or greater slopes and areas with more erodible soils; and forestry clearfelling and regeneration would cause long-term reductions in streamflow yield. (Zielinski-IPA)
W81-03282

WATER SUPPLY AS A LIMITING FACTOR IN WESTERN ENERGY DEVELOPMENT,
Geological Survey, Reston, VA.
G. H. Davis, and F. A. Kilpatrick.
Water Resources Bulletin, Vol 17, No 1, p 29-35, February, 1981. 5 Fig, 1 Tab, 14 Ref.

Descriptors: *Water allocation, *Energy development, *Water supply, Oil shales, Coal mines, Water consumption, Agriculture, Strip mines, Bituminous coal, Colorado River Basin, Missouri River Basin, River basins, Water policy, Planning.

Conflicts between water allocation for agriculture and energy development in the water-deficient western U.S. are discussed. Of the nation's 137

billion tons of strippable coal, 103 billion tons are located in the Upper Colorado and Upper Missouri River basins. Virtually all of the nation's high grade shale oil reserves lie in the Upper Colorado basin. Projected uses for energy development through the year 2000 are about equal to those projected for agriculture, and together account for most of the remaining water allocation. Agricultural interests are facing increased costs and decreased supplies. Detailed development plans for an in situ (80% retorted in the ground) prototype oil shale lease show water consumption estimates of 4,440 acre feet per year for a 76,000 bpd (barrel per day) output. A conventional technology plant would consume three times the water per barrel of oil produced. Environmental acceptability, uncertainty of water supplies, and distance from markets have thus far discouraged western energy development. (Cassar-FRC)
W81-03551

6E. Water Law and Institutions

INTEGRATING LAND AND WATER MANAGEMENT,
Florida Water Resources Research Center, Gainesville.
F. E. Maloney, and R. Hamann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209074, Price codes: A07 in paper copy, A01 in microfiche. Publication No 54, 1981. 134 p, 597 Ref. OWRT-A-037-FLA(1), 14-34-0001-0110.

Descriptors: *Water resources planning, Coordination, *Land use, Water law, Legislation, Administration, Planning, Regulation, *Water management, *Land management.

Sound decisions regarding the use and protection of water cannot be made without considering the effects of land use. Nor is it possible to properly manage land unless planning and regulatory functions are coordinated with water management. Just as the resources are interrelated, so are management programs. Unless management is well integrated, conflicts, inconsistencies, overlap and duplication inevitably result. In Section I of this report, the need for better integration is examined. Numerous programs for the planning and regulation of land and water use currently operate in Florida. Together they form an extremely complex management system. This system is not well integrated, but it demonstrates many subtle interrelationships. In Section II, the major land and water management programs are described and their mutual relations are examined. Improved integration of land and water management can be attained. A range of management techniques are available to enhance communication and resolve inconsistencies. In Section III, several methods are discussed, including reorganization, review and comment procedures, coordinating councils, planning, and coordinated permitting.
W81-03259

INSTITUTIONAL ARRANGEMENTS FOR AREAWIDE WATER RESOURCES MANAGEMENT PLANNING IN THE WASHINGTON, D.C. REGION UNDER THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972,
American Univ., Washington, D.C. School of Government and Public Administration.
H. Lieber.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-208217, Price codes: A08 in paper copy, A01 in microfiche. Water Resources Research Center, University of the District of Columbia, Washington, D.C., Report 17, June, 1980. 147 p. OWRT-B-010-DC(1), 14-34-0001-8072.

Descriptors: *Water management, Water pollution control, Water treatment, District of Columbia, Maryland, Virginia, *Potomac River basin, Water resources development, Water supply development, Government, Legal aspects, Land use, *Decision making, Public administration, Regional planning, Public participation.

The project studied the formulation, acceptance and early implementation of areawide management planning for water quality management, water supply, land use and other related functions by the Water Resources Planning Board of the Metropolitan Washington Council of Governments, established under provisions of P.L. 92-500. This study evaluated past arrangements and decision making procedures for water resources planning in the Washington area, discussed the new management planning process and evaluated its success in limiting jurisdictional coflicts, integrating related functions and increasing citizen participation. The Washington area water resources planning under section 208 of the Clean Water Act was examined. The accomplishments and failures of the 208 plans were discussed.
W81-03261

LAKE TAHOE BASIN WATER QUALITY PLAN, FINAL PLAN.
California State Water Resources Control Board, Sacramento.
Report, 1980. 301 p, 47 Fig, 72 Tab, 5 Append.

Descriptors: *California, Lake basins, *Erosion control, *Algal control, *Lake Tahoe Basin, Algal growth, Lake rehabilitation, Mountain lakes, Cost analysis, Slope degradation, Soil stability, Erosion rates, Forest management, Forestry, Tax rates, *Water pollution control.

Lake Tahoe is an outstanding national resource. The exceptional clarity and purity of the waters of the lake are priceless as both a scientific and a scenic treasure. Federal law requires that the high quality of the lake be maintained. Erosion control is seen as the principal factor in protecting Lake Tahoe's clarity and water quality, and in preventing further deterioration. The Final Water Plan, submitted in accordance with requirements of Section 208 of the Federal Clean Water Act, describes the adverse effects of human activity on the lake, such as erosion from road cuts and off-road vehicles, destruction of natural filtering zones by development, construction on both 'high erosion hazard' lands and stable lands, and impact on runoff absorption when development covers excessive land. Rapid development in the Basin over the past two decades is causing a deterioration of the lake's water quality, including a doubling of the algal growth. The principal control measures outlined are: (1) erosion and urban runoff control; (2) on-site surface runoff control; (3) controls on development; and (4) policies involving forest practices. The report suggests funding sources and describes implementation procedures, including liaison with Nevada authorities. (Garrison-Omniplan)
W81-03288

LAKE TAHOE BASIN WATER QUALITY PLAN, SUMMARY.
California State Water Resources Control Board, Sacramento.
Report, September, 1980. 17 p, 2 Fig, 2 Tab.

Descriptors: *California, Lake basins, *Erosion control, *Algal control, *Lake Tahoe Basin, Algal growth, Lake rehabilitation, Mountain lakes, Cost analysis, Slope degradation, Soil stability, Erosion rates, Forest management, Forestry, Tax rates, *Water pollution control.

This summary describes the Lake Tahoe Basin Final Water Plan, in which erosion control is seen as the principal factor in protecting Lake Tahoe's clarity and water quality, and in preventing further deterioration of the lake. Also described are: the erosion threats to the lake; the five water quality control alternatives, with a full description of Alternative C (Proposed Alternative, Less Restrictive Adherence to Land Capability); costs of remedial projects and management options; development controls possible to prevent erosion; program impacts; and implementation plans. The summary includes the changes to the Lake Tahoe Water Quality Plan since its publication in January, 1980. The principal control measures detailed in the Final Water Plan are summarized in this report. They are: (1) erosion and urban runoff control; (2) on-site surface runoff control; (3) controls on development; and (4) measures involving forest practices. Remedial erosion control projects are estimated to cost $95 million in 1979 dollars. The report suggests funding sources and summarizes implementation procedures, including liaison with Nevada authorities. (Garrison-Omniplan)
W81-03289

THE NPDES PERMIT POLICY AS IT RELATES TO BIOMONITORING,
Environmental Protection Agency, Chicago, IL. Enforcement Div.
For primary bibliographic entry see Field 5A.
W81-03300

CORPORATE RESPONSE TO COASTAL ZONE MANAGEMENT: A CASE STUDY OF THE IRVINE COASTAL AREA,
Harvard Univ., Cambridge, MA. Dept. of Landscape Architecture.
R. K. Belknap.
Coastal Zone Management Journal, Vol 8, No 2, p 123-164, 1980. 6 Fig.

Descriptors: *Land use, *Coasts, *Coastal zone management, Land management, Future planning, *California, Orange County, Shores, Public rights, Federal government, Local governments, State governments, Beaches, Seashores.

The chronological format utilized in the planning of future land use of a 10,000 acre coastal tract in Orange County, California is described. The tract, owned by the Irvine Company of Newport Beach, contains 3.5 miles of beach front. The planning process undertaken by the Irvine Company has taken seven years to execute and has paralleled the evolution of state coastal planning in California, which began in 1972. The process focuses on the consideration of the public or private sector in the designing of land use policy, and each phase is described as a separate lesson that may be used to improve the adoption of future regulations. The company's response to public participation, the use of environmental data, the integration of divergent policies from public agencies, and the effects of the change over time are presented. The impact of intergovernmental policies on integrated and site-specific land-use plans is also considered. (Geiger-FRC)
W81-03393

HISTORIC CHANGES IN TERMINOLOGY FOR WETLANDS,
Forsyte Center, Boston, MA.
D. Moss.
Coastal Zone Management Journal, Vol 8, No 3, p 215-225, 1980. 47 Ref.

Descriptors: *Wetlands, *Terminology, Bayous, Bogs, Fens, Marshes, Muskeg, Swamps, Tide lands, Legislation, Conservation, Water management.

Various terms have been used in legal and lay documentation to describe and label wetlands, including marshes and swamps, in combination with words such as salt, tidal, coastal, etc. The term wetlands is currently used as an all-inclusive term for coastal and inland fresh and saline wet lands that are permanently, intermittently, or periodically inundated. For coastal wetlands the most common terms are marsh, tidal marsh and salt marsh. These coastal wetlands are characterized by a change in vegetation as one proceeds from the lowland to the upland areas. Scientists, lawyers, federal and state natural resource agency personnel, policy-makers and the general public have historically been plagued by the inconsistent use of ill-defined terms for natural areas and resources. A case in point is the continuing attempts by scientists to agree on a definition of an estuary based on chemical, biological and physical properties. Changing public perceptions have caused some changes in the use of key words over the years. (Baker-FRC)
W81-03394

INTEGRATION BRINGS BETTER USE OF WATER RESOURCES,

National Water Council, London (England).
P. F. Stott.
Water/Engineering and Management, Vol 128, No 3, p 58-59, March, 1981.

Descriptors: *Water resources development, *Waste water treatment, *Management, Regional development, Water distribution, Social aspects, Taxes, *England, Governments, Local governments, Sewerage, Water pollution control, Water rates, Planning.

In England and Wales the 1,600 water and sewage boards, authorities, and companies were consolidated into 10 large multi-purpose water authorities, responsible for integrated development of all aspects of the hydrologic cycle. Water resources, distribution and supply, sewerage and sewage treatment, pollution control, river management, land drainage, flood protection, sea defenses, recreation, and fisheries are all within the domain of the new water authorities. Boundaries were determined by catchment of river basins. In the years since its inception in 1974, the new organization effectively handled a severe drought. It has become more visible to the public and has been able to use resources more economically. Problems include old, outdated sewers, cutbacks in funds, and implementing an unpopular direct billing system. (Cassar-FRC)
W81-03415

GROUND-WATER MANAGEMENT IN THE HIGH PLAINS,
Oklahoma Water Resources Board, Oklahoma City. Planning Div.
G. Wickersham.
Ground Water, Vol 18, No 3, p 286-290, May/June, 1980. 3 Fig, 2 Tab, 9 Ref.

Descriptors: *Groundwater management, *High Plains, Oklahoma, Ogallala aquifer, Texas, Colorado, Groundwater control, Government, Local government, State jurisdiction, *Mid-continent region.

Various laws affect water management in the High Plains region of mid-America. These different laws arise from different situations regarding the groundwater found in various locations within that area. In Texas the ground water is owned by the land owners and comes under their management as property rights. Local management districts are used to control the groundwater usage in that area. In Colorado the state controls groundwater, and its use is regulated by the State Engineer. Oklahoma features tight control on usage through limitations on pumpage, but still honors ownership by the individual landowner. Despite these great differences in approaches to groundwater management, six of the area states have joined in an effort to study the ground water situation in the Ogallala aquifer. The economic aspects of mining the groundwater there will be explored, and future water resources management for the area will be investigated. (Baker-FRC)
W81-03429

EEC BATHING WATER STANDARDS,
S. H. Jenkins.
Marine Pollution Bulletin, Vol 12, No 2, p 33-34, February, 1981.

Descriptors: *Water quality standards, *Beaches, *Bacteria, Public health, Salmonella, Enterobacter, *United Kingdom.

The 1975 bathing water policy of the Council of the European Economic Community required that water for sea bathing must meet certain standards within 10 years. This Directive listed the limiting values of physico-chemical standards either as guidelines or as mandatory values. In the United Kingdom, there is much discussion on the microbial standards because of doubts about the comparability of the reference methods and the variability of the results of coliform enumeration, and the statistical soundness of imposing bacterial limits which are expressed in different percentile values. Scientists also question the soundness of including standards for Salmonellae and enteroviruses, which might imply that they were necessary for the protection of bathers. The EEC Directive differs from the standards set for microbial quality by the California State Water Resources Control Board. There is no public health evidence in the United Kingdom that bathing or shellfish consumption should be prohibited solely on account of non-compliance with microbial parameters in the EEC Directive. These standards do not come into force until 1985, so the agreed-upon microbial standards may be met. (Small-FRC)
W81-03498

EVIRONMENTAL PROTECTION IN HUNGARY AND POLAND,
University of Southern Maine, Portland.
E. J. Kormondy.
Environment, Vol 22, No 10, p 31-37, 1980.

Descriptors: *Poland, *Hungary, *Industrial wastes, *Water pollution control, Environment, Water pollution sources, Water policy, Industrial plants, Pollution abatement, Water quality, Governments, Foreign countries.

Although Hungary and Poland are geographically and politically similar, they differ greatly in their attitudes and actions toward their environments. In Hungary there is a pervasive level of environmental awareness. The 1976 Environmental Protection act gives high priority to water protection and improvement of water quality, since water polluted by sewage, agricultural wastes, and industrial wastes is the primary environmental problem. The Central Environmental Protection Fund is designated for development of low-waste technologies and major construction. Industries are encouraged to improve water quality through progressive fines and tax reductions if compliance measures are costly. Poland places more emphasis on industrial development, often at the expense of the environment. Although there is no overall environmental protection act, many ministries are involved in research and enforcement. During two 5-year plans in the 1970's, there was emphasis on non- and low-waste technology, water purification, and pollution abatement. Environmental research is conducted at several universities, and the academic community is well aware of environmental deterioration, but the average citizen is not receiving this information. (Cassar-FRC)
W81-03545

POTW NONCOMPLIANCE,
Cook Coll., New Brunswick, NJ.
W. Goldfarb.
Water Resources Bulletin, Vol 17, No 1, p 152-153, February, 1981.

Descriptors: *Legal aspects, *Public utility districts, Legislation, Sewage works, Water pollution treatment, Permits, Water pollution control.

Problems encountered when publically owned treatment works (POTW's) fail to comply with permits regarding allowable discharges are considered. The case of Detroit, Michigan is used as an example. The courts stepped in and appointed the Mayor of that city as temporary administrator over the operations of the POTW, with power to manage and conduct its operations under court supervision. Even a step such as this is not without its problems. As a constitutional matter, the courts cannot directly compel legislatures to authorize and appropriate money, or municipal executives to raise or spend it. When adequately trained personnel simply are not available, no court can compel the POTW to hire them. In the long run the answer to the problem of water pollution by POTW's is seen as a political rather than a legal one. (Baker-FRC)
W81-03548

THE MILWAUKEE POLLUTION CASE--IMPLICATIONS FOR WATER RESOURCES PLANNING,
Great Lakes Basin Commission, Ann Arbor, MI.
M. Donovan, C. A. Job, and W. C. Sonzogni.
Water Resources Bulletin, Vol 17, No 1, p 23-28, February, 1981. 1 Tab, 17 Ref.

Descriptors: *Water law, *Planning, Great Lakes, *Water pollution control, *Milwaukee, Wisconsin, Legal aspects, *Lake Michigan, Sewage effluents, Ecology, Illinois v. Milwaukee case, Clean Water Act, Combined sewers, Lakes, Water quality, Common law, Judicial decisions, Costs.

The Illinois v. Milwaukee Federal Court decision of 1977 requires the city to completely eliminate its combined sewer outflow into Lake Michigan by 1989 at a possible cost of 1.3 billion 1978 dollars. The case, pending before the Supreme Court, is an example of an application of the federal common law of nuisance to an interstate pollution problem where a pollution threat, rather than a proven hazard, is involved. The treatment required is more extensive than that stipulated by existing pollution control regulations and must be implemented whether or not federal funds are available. The comprehensive Clean Water Act was unable to deal with this interstate water quality conflict. If this decision sets a precedent, the U.S. EPA water quality cleanup program may be affected. When dealing with a shared water resource such as the Great Lakes, an integrated approach is necessary to avoid litigation and spread the cost of compliance more evenly among the communities. (Cassar-FRC)
W81-03554

FISHABLE, SWIMMABLE WATER,
CH2M/Hill, Milwaukee, WI.
C. V. Gibbs.
Water/Engineering and Management, Vol 128, No 3, p 42-44, 47, 101, March, 1981.

Descriptors: *Water pollution control, *Engineering, *Alternative planning, Legal aspects, Planning, Legislation, Waste water treatment, Economics, Costs, Management, Water resources development, Sewerage.

In spite of environmental legislation and efforts to improve water quality during the last decade, many pollution problems still exist throughout the U.S. Since not all these problems can be solved at once, the author lists several priorities: (1) Funding for municipal wastes treatment must be developed. The need for this purpose was estimated by the EPA at $167 billion 1978 dollars. (2) Management must realize that new treatment plants with sophisticated machinery require a more highly-trained and better paid staff than the old systems. (3) Alternative sewage treatment and disposal systems must be considered. (4) Nonpoint pollution must be controlled. Engineering professional must become community oriented and aim toward reconciling public expectations with the available money. (Cassar-FRC)
W81-03585

6G. Ecologic Impact Of Water Development

COMMUNITY STRUCTURE DYNAMICS OF EPILITHIC AND EPIPHYTIC DIATOMS IN A SHALLOW, CALCAREOUS MISSISSIPPI STREAM,
Mississippi State Univ., Mississippi State. Dept. of Biological Science.
S. R. O'Quinn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209207, Price codes: A03 in paper copy, A01 in microfiche. MS Thesis, May, 1981, 39 p, 3 Fig, 7 Tab, 34 Ref. OWRT-A-133-MISS(1), 14-34-0001-0126.

Descriptors: *Diatoms, Algae, Cladophora, Nitzschia, Epiphytes, *Ecosystems, Aquatic environment, *Environmental effects, Water temperature, Light penetration, Water depth, Water quality, Mississippi, *Sessums Creek, Rhizoclonium, Navicula minima Grun, Nitzschia Dissipata (Kutz) Grun.

Epilithic and epiphytic diatoms were collected over a one-year period from both shaded and unshaded sites of Sessums Creek, a shallow, calcareous stream, low in nutrients and strongly alkaline, in northeastern Mississippi. The dominant macro-

algae were filamentous forms of the non-mucilage producing genera Cladophora and Rhizoclonium - ideal substrates for epiphytic diatom growth. Diatoms were identified using light and scanning electron microscopy, and the resulting floristic list is the first from the freshwater habitats of Mississippi. Ninety taxa were identified with Navicula minima Grun. and Nitzschia dissipata (Kutz.) Grun. accounting for one-half of all individuals counted. With few exceptions, the more dominant taxa were equally abundant in the shaded and unshaded sites and also in the epilithon and epiphyton. Temporal changes in community diversity were described by the Shannon Index (H') and the number of taxa in a sample. Diversity in all four habitats sampled showed an identical temporal pattern being lowest in the winter and highest in the fall. Comparison by a similarity index (SIMI) showed that no sample pair was more similar than any other sample pair. It was concluded that within the locality sampled, Sessums Creek supported a single nearly homogeneous diatom community, little affected by differences in light intensity or substrate type.
W81-03263

TOLERANCE OF OAKS TO FLOODING,
California Univ., Davis. Dept. of Environmental Horticulture.
R. W. Harris, A. T. Leiser, and R. E. Fissell.
In: Proceedings of the Symposium on the Ecology, Management, and Utilization of California Oaks, June 26-28, 1979, Claremont, California. Forest Service, Pacific Southwest Forest and Range Experiment Station, Berkeley, California, General Technical Report PSW-44, November, 1980, p 238-241. 2 Fig, 3 Tab, 1 Ref.

Descriptors: *Reservoirs, *Oak trees, Tolerance, *Flooding, *Mortality, Flood damage, Drawdown, Water level, Soil environment, Ecological effects, California.

Established native oaks have the reputation of being sensitive to changes in their soil environment. Oaks, therefore, were of particular interest when studies were begun in 1967 on the flood tolerance of woody plants in the draw-down zones of several central California reservoirs. The gross-pool levels of two reservoirs (Black Butte and Terminus) were raised at least 13 and 25 ft respectively, above their original designed levels. Andrus and Brannan Islands in the Sacramento-San Joaquin Delta were also surveyed two years after they were flooded in 1972. Mature blue oaks and valley oaks growing on alluvial soils withstood flooding for 50 to 98 days each of three years with little or no tree loss. Blue oaks on shallower residual soils suffered 50% mortality each year with similar flooding. It is recommended that all interior live oaks should be removed below expected maximum gross pool. Blue oaks can be left which will not be flooded to more than 75% of their height at the mean gross pool in the drawdown areas on previously dry hillsides which may be flooded for 80 days or less and on more moist alluvial fans which may be flooded for 100 days or less. Valley oaks should tolerate equal or greater flooding than blue oaks. (Moore-SRC)
W81-03311

ECOLOGICAL CHARACTERIZATION OF THE SEA ISLAND COASTAL REGION OF SOUTH CAROLINA AND GEORGIA; EXECUTIVE SUMMARY,
South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Div.
For primary bibliographic entry see Field 2A.
W81-03313

ECOLOGICAL CHARACTERIZATION OF THE SEA ISLAND COASTAL REGION OF SOUTH CAROLINA AND GEORGIA; VOLUME I; PHYSICAL FEATURES OF THE CHARACTERIZATION AREA.
South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Div.
For primary bibliographic entry see Field 2A.
W81-03314

ECOLOGICAL CHARACTERIZATION OF THE SEA ISLAND COASTAL REGION OF SOUTH CAROLINA AND GEORGIA; VOLUME II; SOCIOECONOMIC FEATURES OF THE CHARACTERIZATION AREA.
South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Div.
For primary bibliographic entry see Field 2A.
W81-03315

ECOLOGICAL CHARACTERIZATION OF THE SEA ISLAND COASTAL REGION OF SOUTH CAROLINA AND GEORGIA; VOLUME III; BIOLOGICAL FEATURES OF THE CHARACTERIZATION AREA.
South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Div.
For primary bibliographic entry see Field 2A.
W81-03316

AN ECOLOGICAL CHARACTERIZATION OF THE PACIFIC NORTHWEST COASTAL REGION, VOLUME THREE, CHARACTERIZATION ATLAS, ZONE AND HABITAT DESCRIPTIONS,
Ryckman, Edgerley, Tomlinson and Associates, Inc., Bellevue, WA.
C. M. Proctor, J. C. Garcia, D. V. Galvin, G. B. Lewis, and L. C. Loehr.
Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-79-13, July, 1980. 432 p, 197 Fig, 22 Tab, 73 Ref. 14-16-009-77-019.

Descriptors: *Pacific Northwest, *Ecosystems, *Habitats, *Models, *Ecological distribution, Watersheds, Zones, Coastal waters, Food chains, Succession, Species composition, Species diversity, Population density, Wildlife.

This volume supplements the conceptual model for ecological characterization by providing extensive modeling at the habitat and zone level. Delineation of zones is based on dominant vegetation (surface cover) and land form for inland areas; on topography and tidal range for coastal areas; on substrate and light penetration in the ocean; and on intensity, quality, and frequency of land use in areas of human activity and habitation. The zones delineated are: alpine highlands; slopes and lowlands; estuaries; beaches and dunes; headlands and rocky islands; pelagic oceanic zones; benthic oceanic zones; and inland and coastal human activity zones. Thirty ecosystem models were prepared, covering all the major basic habitats, including models for food webs, community composition, succession, environmental indices, and ecosystems. Community composition lists are provided for eighteen habitats, listing scientific and common names, range, abundance and environmental status. (Brambley-SRC)
W81-03324

AN ECOLOGICAL CHARACTERIZATION OF THE PACIFIC NORTHWEST COASTAL REGION, VOLUME FOUR, CHARACTERIZATION ATLAS, WATERSHED UNIT DESCRIPTIONS,
Ryckman, Edgerley, Tomlinson and Associates, Inc., Bellevue, WA.
C. M. Proctor, J. C. Garcia, D. V. Galvin, G. B. Lewis, and L. C. Loehr.
Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-79/14, July, 1980. 612 p, 126 Fig, 58 Tab, 2045 Ref, 2 Append. 14-16-0009-77-019.

Descriptors: *Pacific Northwest, *Watersheds, *Ecosystems, *Habitats, *Coastal waters, Marine environment, Zones, Orography, Geography, Structural geology, Climates, Species composition, Economics, Human population, Wildlife habitats.

This volume completes the ecological characterization of the Pacific Northwest Coastal Region by presenting the watershed unit descriptions. The area is divided into nine watersheds and the ocean. The watersheds are: Olympic Rainforest; Willapa-Grays Harbor; Columbia Estuary; Oregon North Coast; Oregon Mid Coast; Lower Umpqua and Lower Rogue; Coos-Coquille; Oregon-California Border; and Redwood Coast. For each watershed unit there is a unit summary, topic references for each of the physical-chemical, biological and socioeconomic environments, and a unit annotated bibliography. The summaries contain descriptions of the major features of the watershed, with information on the lithospheric, atmospheric and hydrospheric features of the physical environment: biological zonation, species of concern and areas of ecological concern in the biological environment: and human activity including population, income and employment, and economic base and activities among the socioeconomic aspects. (Brambley-SRC)
W81-03325

AN ECOLOGICAL CHARACTERIZATION OF THE PACIFIC NORTHWEST COASTAL REGION, VOLUME FIVE, DATA SOURCE APPENDIX,
Ryckman, Edgerley, Tomlinson and Associates, Inc., Bellevue, WA.
C. M. Proctor, J. C. Garcia, D. V. Galvin, M. B. Bailey, and G. W. Brown, Jr.
Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-79/15, July, 1980. 73 p, 7 Fig, 1 Tab, 738 Ref. 14-16-0009-77-019.

Descriptors: *Data collections, *Bibliographies, *Ecosystems, *Pacific Northwest, Computers, Computer programs, Habitats, Zones, Trophic level, Seasonal distribution, Animals, Plants, Wildlife, Coastal area.

This volume concludes the ecological characterization of the Pacific Northwest Coastal Region with presentation of the annotated bibliography, the annotated species list, the data gaps report and the references to this volume. Part of the volume, but on file with the U.S. Fish and Wildlife Service Office in Portland, Oregon, are the computer print-out of the annotated bibliography, the computer print-out of the annotated species list, a data tape of the annotated bibliography and glossary of terms, and program notes for the FAMULUS document and for the annotated species list. The bibliography is described, including the advantages of computerization, and its preparation through the FAMULUS program. The annotated species list is a computerized information system which relates the species of the study area to the biological zones and particular habitats within the area. The system includes information on seasonality, relative abundance, trophic level, and status with additional notes. A selected bibliography of 680 references for a number of the vertebrate species on the list, with status authorities for the rare endangered or threatened plants is presented. Data gaps are identified for the physical-chemical, biological and socioeconomic areas. (Brambley-SRC)
W81-03326

POLICY-RELEVANT ASSESSMENT OF COASTAL ZONE MANAGEMENT PROGRAMS,
Hawaii Univ., Honolulu.
G. K. Lowry.
Coastal Zone Management Journal, Vol 8, No 3, p 227-255, 1980. 1 Fig, 1 Tab, 43 Ref.

Descriptors: *Resources management, *Coastal waters, *Coastal zone management, *Hawaii, Resources development, Planning, Water resources development, Policy making, Administrative decisions.

This paper identifies a set of policy relevant approaches to the evaluation of coastal zone management programs. The central purpose of policy relevant evaluative research is to provide information directly useful for making decisions about the development, alteration, or termination of coastal zone management programs. Various attributes of policy relevant evaluation research are described, including the understanding of when policy decisions need to be made, whether evaluative information is required to make these particular decisions, what types of evaluative information are needed, and whether this information can be supplied in the time allowed. Five approaches to the evaluation of coastal zone management programs

are discussed, including program logic, compliance, process, goal achievement and impact. In many coastal states the federally sponsored coastal resource management efforts are the largest, most visible and most controversial resource management activities undertaken. Thus it is important for policy makers to be able to judge the effectiveness of these operations. (Baker-FRC)
W81-03386

AQUACULTURE SITING ISSUES IN WASHINGTON'S COASTAL ZONE,
Department of Energy, Seattle, WA. Region X.
N. Evans.
Coastal Zone Management Journal, Vol 8, No 3, p 189-213, 1980. 29 Ref.

Descriptors: *Aquaculture, *Resources management, *Washington, *Coastal waters, Clams, Mussels, Salmon, Algae, Oysters, Risk-benefit analysis, Resources development, Water resources development, Marine development.

Land use planning concepts in relation to aquaculture siting issues along Washington's coastal zone are considered. As aquaculture activities continually expand, a greater commitment of aquatic resources is made. Simultaneously expanded recreational and residential uses of the same areas put increased demands on the same water resources. Conflicts continue to grow in areas where multiple use becomes a problem. The analysis of these types of situations presented in this paper is based on recent public debates concerned with the harvest of clams by mechanical means, the raft culture of mussels and the pen rearing of salmon. Conflicts surfaced in the areas concerned with subtidal harvest of geoducks, raft culturing of marine algae for food and chemical extracts, and the continuing use of public nearshore aquatic areas for private oyster farming. It is suggested that better coastal management techniques are needed that will address the questions of environmental impact and risk, esthetic quality claims which must be evaluated and measured, and the selection of methods that can be used to plan for the aquatic areas while recognizing the special features these areas possess. (Baker-FRC)
W81-03395

FRESHWATER ANGLING IN THE TRANSVAAL: ITS ENVIRONMENTAL AND ECONOMIC IMPACT,
Transvaal Provincial Administration, Pretoria (South Africa). Dept. of Nature Conservation.
J. J. Cadieux.
South African Journal of Science, Vol 76, No 11, p 492-493, November, 1980. 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Public waters, *Fishing, Recreation, Fish populations, Fish management, Fish conservation, Sport fishing, Recreation demand, *South Africa, Recreation facilities, Economic impact.

This study was performed using data gathered during the 1977-1978 angling season to determine the pressure of angling in the dams and rivers of the Transvaal, to ascertain the most sought-after fish, to determine the popularity and quality of angling, and to determine the economic impact of the sport. Based on the response to questionnaires, the anglers spent an average of 27.7 days/year engaged in this activity per angler. The majority of the time was spent at impoundments and rivers near main population centers, with Hartbeespoort Dam, Vaal Dam, Roodeplaat Dam and the Vaal River west of the Vaal Dam being the most frequented. Carp was the fish most preferred to catch, followed by kurper and yellow fish. During this season anglers caught an estimated 9.50 million fish in Transvaal waters. This study suggests that sport fishing and angling have become important outdoor activities among South Africans and that knowledge of the participants and their environmental impact is essential for the proper management and future success of the sport. (Baker-FRC)
W81-03514

7. RESOURCES DATA

7B. Data Acquisition

TRACING GROUND-WATER MOVEMENT BY USING THE STABLE ISOTOPES OF OXYGEN AND HYDROGEN, UPPER PENITENCIA CREEK ALLUVIAL FAN, SANTA CLARA VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-03271

DETERMINATION OF LAND USE FROM SATELLITE IMAGERY FOR INPUT TO HYDROLOGIC MODELS,
Hydrologic Engineering Center, Davis, CA.
R. P. Webb, R. Cermak, and A. Feldman.
Technical Paper No 71, April, 1980. 15 p, 5 Fig, 4 Tab, 10 Ref.

Descriptors: *Hydrologic models, *Remote sensing, *Satellite technology, *Land use, *Watersheds, Model studies, Simulations, Costs, Data acquisition, Data interpretation.

A land use/land cover model identification methodology using LANDSAT imagery has been applied to six watersheds across the United States. The land use information is stored in a grid cell data bank and is the basis for calibration of hydrologic parameters for watershed models. Available ground truth data permitted the identification of seven land cover categories from the LANDSAT imagery: agricultural, residential/highways, industrial/commercial, grassland, forest, undeveloped open space, and water. Hydrologic simulations were made of four watersheds using both conventional and LANDSAT land use data. Cell by cell comparisons were made between the conventional and all of the LANDSAT land use classifications to get an indication of spatial accuracies associated with LANDSAT data and the classification procedures. The discharge curves from LANDSAT and conventional data were not significantly different, and the LANDSAT derived land use classification procedures were well within an acceptable error to be used for hydrologic modeling. The LANDSAT data are acceptable for hydrologic modeling, with the advantages of lower cost, greater availability, compatibility with other classification computer programs and resampling capability. (Brambley-SRC)
W81-03319

STOCHASTIC GENERATION OF TEMPERATURE AND SOLAR RADIATION DATA,
Science and Education Administration, Chikasha, OK.
A. D. Nicks, and J. F. Harp.
Journal of Hydrology, Vol 48, No 1/2, p 1-17, August, 1980. 1 Fig, 10 Tab, 21 Ref.

Descriptors: *Model studies, *Stochastic processes, *Temperature, *Solar radiation, Weather data, Meteorological data, Evapotranspiration, Hydrology, Mathematical models, Markov processes, Air temperature.

A model for stochastic generation of long term weather data produced daily maximum and minimum temperatures and total solar radiation data usable in hydrologic models. Most of the generated data agreed well with Oklahoma measured data, with the following exceptions: January maximum and minimum temperatures, and December mean radiation value. Monthly evapotranspiration data calculated from simulated data and from historical data did not differ statistically. (Cassar-FRC)
W81-03431

THE EFFECT OF SNOW DRIFTING ON GAMMA SNOW SURVEY RESULTS,
Saskatchewan Dept. of the Environment, Regina.
H. F. Cork, and H. S. Loijens.
Journal of Hydrology, Vol 48, No 1/2, p 41-51, August, 1980. 5 Fig, 1 Tab, 10 Ref.

Descriptors: *Snow surveys, *Water equivalent, *Gamma rays, Snowpacks, Remote sensing, Snowmelt, Mathematical studies, *North Dakota.

The gamma radiation attentuation method of measuring snow cover water equivalent produces underestimates if drifting is present. An analytical expression has been developed to correct this problem provided some ground measurements are available--the water equivalent of drifts and in-between areas, as well as the proportion of drifts to non-drifts. During a 1975 survey of the Souris Basin, Saskatchewan-North Dakota, gamma and ground measurements agreed as well as expected, the gamma data being slightly higher than the ground data. During the 1976 survey, snow melt had begun at the time of measurement, producing patchy snow and melt water puddles. These gamma results were less than the ground data by 10-15%. When drifts are further apart and deeper, the underestimate increases. (Cassar-FRC)
W81-03432

DEMARCATION OF FRESH- AND SALINE-WATER ZONES, USING ELECTRICAL METHODS (ABOHAR AREA, FEROZEPUR DISTRICT, PUNJAB),
Geological Survey of India, Calcutta.
For primary bibliographic entry see Field 2F.
W81-03436

THE SNOW COVER OF SEA ICE DURING THE ARCTIC ICE DYNAMICS JOINT EXPERIMENT, 1975 TO 1976,
For primary bibliographic entry see Field 2C.
W81-03460

SATELLITE DETECTION OF SEICHES IN GREAT SALT LAKE, UTAH,
National Oceanic and Atmospheric Administration, Washington, DC.
M. Matson, and C. P. Berg.
Water Resources Bulletin, Vol 17, No 1, p 122-128, February, 1981. 7 Fig, 2 Tab, 21 Ref.

Descriptors: *Lakes, *Seiches, *Satellite technology, *Great Salt Lake, Utah, Sediments, Water levels, Meteorology, Remote sensing, Water circulation, Mixing, Water currents, Turbulence.

Satellite technology detected an unusual brightness in the north arm of Great Salt Lake, Utah, on June 15, 1977. Visible band imagery from NOAA-3, 4, and 5 satellites (National Oceanic and Atmospheric Administration) Very High Resolution Radiometer and on Landsat-2 disclosed 12 similar previous anomalies, and 9 more were seen between June 1977 and May 1978. Comparisons of lake levels and meteorological conditions led to the conclusion that sediment resuspension caused by wind-induced seiches was responsible for the brightness. (Cassar-FRC)
W81-03549

STAINING MIXED-LIQUOR BIOTA,
Williamsport Sanitary Authority, PA.
M. Gerardi.
Water and Sewage Works, Vol 127, No 6, p 64, 74, June, 1980. 2 Fig, 2 Tab, 2 Ref.

Descriptors: *Mixed liquor solids, *Technology, Bacteria, Microorganisms, Solids, Wastewater treatment, Wastewater facilities.

Numerous benefits can be obtained from the preparation of a permanent and reliable microslide record of mixed liquor (ML) biota for correlation with treatment plant conditions. Such a record can yield information that will effectively improve plant performance, or it can be an on site research tool for further studies of ML biota and an educational record for training plant operators in the wastewater field. Crystal violet and fast green FCF are used to stain and differentiate the cellular structure of the mixed-liquor biota and to place the biota in sharp contrast with its background. Before staining can be done the biota must be fixed to a microslide. (Baker-FRC)
W81-03561

WATER/WASTEWATER PROCESS CONTROL INSTRUMENTATION - PHYSICAL PARAMETERS AND THEIR MEASUREMENT,
R. H. Babcock.
Water and Sewage Works, Vol 127, No 5, p 60-62, 76, May, 1980. 3 Fig.

Descriptors: *Measuring instruments, *Process control, *Water treatment, Wastewater treatment, Pressure measuring instruments, Temperature control, Flow measurement, Water pressure, Water flow, Remote sensing.

The fundamental physical parameters of pressure, differential pressure, and temperature are essential variables applied to the effective control of water and wastewater processes. Questions which must be answered in deciding which measuring instrument to purchase are discussed. For pressure measurements the techniques in use today are the classical mechanical methods, whether direct or indirect. The earliest measuring instruments were based on the concept of physical displacement, as in the Bourdon gage. Today, where the instrument incorporates electrical or electronic components, the components are mere detectors of displacement or force. The measurement of liquid level depends on circumstances, and the most commonly used level-indicating method is the bubble tube. One variation of the tube is the diaphragm box, which uses a trapped air supply. The measurement of temperature is commonly done with mercury thermometers and instrument types such as mechanical thermometers or filled systems, and electrical devices such as the thermocouple or resistance bulb. Flow measurements are dominated by inferential flow systems such as the venturi. (Baker-FRC)
W81-03562

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA FOR TENNESSEE, WATER YEAR 1979.
Geological Survey, Nashville, TN. Water Resources Div.
Geological Survey Water-Data Report TN-79-1, January, 1981. 491 p, 6 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Tennessee.

Water resources data for the 1979 water year for Tennessee consist of records of stage, discharge, and water quality of streams and springs; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 110 gaging station, stage only records for one lake gaging station, elevation and contents for 27 lakes and reservoirs, water quality for 67 stations and 27 wells, and water levels for 27 observation wells. Also included are 105 crest-stage partial-record stations, 48 low-flow partial-record stations, and 80 coal-hydrology partial-record stations. Additional water data were collected at various stream and spring sites not involved in the systematic data collection program and are published as miscellaneous measurements and analyses, or as seepage investigations of discharge and water quality. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Tennessee. (USGS)
W81-03272

WATER RESOURCES DATA FOR MARYLAND AND DELAWARE, WATER YEAR 1980.
Geological Survey, Towson, MD. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-195885, Price codes: A19 in paper copy, A01 in microfiche.
Geological Survey Water-Data Report MD-DE-80-1, March, 1981. 431 p, 4 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Maryland, *Delaware.

Water resources data for the 1980 water year for Maryland and Delaware consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 110 gaging stations, stage and contents at 1 reservoir, water quality at 46 gaging stations and 19 wells, and water levels at 27 observation wells. Also included are data for 14 crest-stage, 56 low-flow, and 4 tidal crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Maryland and Delaware. (USGS)
W81-03273

WATER RESOURCES DATA FOR ARIZONA, WATER YEAR 1979.
Geological Survey, Tucson, AZ. Water Resources Div.
Geological Survey Water-Data Report AZ-79-1, 1980. 614 p, 8 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Arizona.

Water resources data for the 1979 water year for Arizona consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; water levels of observation wells; and quality of ground water. This report contains discharge records for 237 gaging stations, annual peaks for 77 crest-stage partial-record stations, and discharge measurements at 79 miscellaneous sites; contents only records for 8 lakes and reservoirs; stage and contents for 1 lake; elevation and discharge for 1 streamflow station; elevation only for 1 streamflow station; gage height only for 1 head over a dam; 16 supplementary records, included with gaging-station records, consisting of monthend or monthly stage, contents, and evaporation of lakes and reservoirs, diversions, and return flows; water-quality records for 87 continuous-record stations and 22 miscellaneous sites; water levels for 95 observation wells; and water-quality data for water from 648 wells. The data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating Federal and State Agencies in Arizona. (USGS)
W81-03274

RECONNAISSANCE OF THE WATER RESOURCES OF THE WOODWARD QUADRANGLE, NORTHWESTERN OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
R. B. Morton.
Oklahoma Geological Survey Hydrologic Atlas 8, 1980. 4 Sheets, 13 Fig, 3 Tab, 1 Ref.

Descriptors: *Maps, *Groundwater, *Surface water, Water quality, Available water, Geohydrology, Wells, Aquifer characteristics, Water yield, Water use, Irrigation, Groundwater movement, Water level fluctuations, Groundwater recharge, Chemical analysis, Hydrographs, Hydrologic data, *Oklahoma, *Woodward quadrangle.

Urbanization, economic growth, and improved standards of living in rural areas of Oklahoma require ever-increasing amounts of water. Reconnaissance appraisals of the water resources are being made, with special emphasis on ground water, in selected areas of the State. The Woodward quadrangle, which includes about 7,800 square miles in northwestern Oklahoma, was selected for appraisal because of the need for information on the distribution and hydrologic characteristics of the various aquifers, surface-water resources, and chemical quality of both ground and surface waters. (USGS)
W81-03275

RECONNAISSANCE OF THE WATER RESOURCES OF THE ENID QUADRANGLE, NORTH-CENTRAL OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
R. H. Bingham, and D. L. Bergman.
Oklahoma Geological Survey Hydrologic Atlas 7, 1980. 4 Sheets, 14 Fig, 4 Tab, 2 Ref.

Descriptors: *Maps, *Groundwater, *Surface water, Streamflow, *Water quality, Available water, Geohydrology, Wells, Aquifer characteristics, Water yield, Water use, Irrigation, Groundwater movement, Water level fluctuations, Groundwater recharge, Chemical analysis, Hydrographs, Hydrologic data, *Oklahoma, *Enid quadrangle.

Urbanization, economic growth, and improved standards of living in rural areas have increased water requirements in Oklahoma. To provide information on a regional basis, reconnaissance appraisals of water resources are being made, with special emphasis on ground water, throughout the State. The Enid quadrangle, which includes about 7,800 square miles in north-central Oklahoma, is the seventh region included in appraisal studies. Material in this atlas includes information on the geology of the area, the distribution and potential yield of the aquifers, the availability of surface water, the chemical quality of surface and ground water, and data on the physical quality of surface water. (USGS)
W81-03276

GEOLOGY AND WATER RESOURCES OF HAND AND HYDE COUNTIES, SOUTH DAKOTA. PART II: WATER RESOURCES,
Geological Survey, Huron, SD. Water Resources Div.
N. C. Koch.
South Dakota Geological Survey Bulletin 28, 1980. 46 p, 28 Fig, 18 Tab, 20 Ref.

Descriptors: *Groundwater, *Surface water, *Water quality, Aquifer characteristics, Wells, Water yield, Water use, Water level, Streamflow, Flow rates, Floods, Groundwater recharge, Chemical analysis, Water analysis, Geohydrology, Hydrologic data, *South Dakota, Hand County, Hyde County.

Four major glacial aquifers, the Tulare, Highmore, Elm Creek, and Bad-Cheyenne River aquifers, in Hand and Hyde Counties, S.Dak., yield as much as 1,000 gallons per minute to wells. The Tulare aquifer occurs from 10 to 200 feet below land surface and water levels in wells are generally less than 50 feet below land surface. The Highmore aquifer occurs from 20 to 200 feet below land surface and the depth to water in wells is generally less than 100 feet below land surface. The Elm Creek aquifer occurs from 20 to 100 feet below land surface and water levels in wells are generally less than 30 feet below land surface. The Bad-Cheyenne River aquifer occurs from 250 to 330 feet below land surface and water levels in wells are from 10 to 210 feet below land surface. The quality of water from the Bad-Cheyenne River aquifer is not suitable for irrigation because of a high salt content. The quality of water from the other three glacial aquifers is suitable for irrigation and is being used for this purpose. The major bedrock aquifers, which underlie the entire area, are sandstone at depths greater than 900 feet below land surface; the quality of water is not suitable for irrigation because of the high salt content. (USGS)
W81-03277

HYDROGEOLOGIC DATA FROM NORTH-CENTRAL KANSAS,

Geological Survey, Garden City, KS. Water Resources Div.
L. E. Stullken.
Kansas Geological Survey Basic Data Series Ground-Water Release 7, 1980. 46 p, 1 Fig, 1 Plate, 4 Tab, 6 Ref.

Descriptors: *Hydrologic data, *Groundwater, *Water resources development, *Wells, Geologic units, Well data, Water level, Water yield, Base flow, Lithologic logs, Water quality, Chemical analysis, *Kansas, North-central Kansas.

Hydrogeologic data were collected during 1976-78 in an area that included all of Ellis, Graham, Norton, Osborne, Phillips, Rooks, Russell, Smith, and Trego Counties in north-central Kansas. The data are provided for use in studying and planning water-resources development in the nine-county area. General information on the potential of the water-bearing formations is available in many parts of the area. The character and thickness of materials are described in 134 lithologic logs of test holes that were drilled as part of this investigation. Data on water levels and yields are given for 852 irrigation, public-supply, and industrial wells. The quality of water from the formation may be generally indicated by chemical analysis of samples from the streams during winter months because base flow consists principally of ground-water discharge. Chemical analyses are provided for water samples collected at 14 sites as part of a seepage-salinity investigation of the North and South Fork Solomon Rivers. (USGS)
W81-03278

INSTITUTIONAL SUPPORT OF WATER RESOURCE MODELS,
Hydrologic Engineering Center, Davis, CA.
J. C. Peters.
Technical Paper No 76, May, 1980. 22 p, 1 Ref.

Descriptors: *Computer models, *Water resources, Quality control, Technology transfer, Maintenance, Education, Information exchange, Documentation, Training, Evaluation.

Thirteen problems are identified that inhibit effective development and use of water resource computer models. Possible solutions to the problems are addressed under the topics quality control, technology transfer, model improvement and maintenance, and education of managers/decision makers. Model quality depends upon model reliability, computational efficiency, ease of use, transportability, and documentation. Standards are being developed for model development and documentation for the improvement of model quality. Technology transfer deals with the passing of information between model developer and model user, and in particular with procedures for fostering proficiency in model application. Mechanisms for technology transfer include dissemination of information regarding model availability, publication of model documentation, provision of user-assistance services, and training of model users. Model improvement and maintenance should be closely associated with technology transfer, through a centralized facility. Changes are made in the models to correct errors, increase computational efficiency, add new capability or modify input or output structure, and maintain model documentation. Managers should be aware of the limitations of models, and what they are able to do within these limits. This awareness can also be offered by the centralized facility for technology transfer. (Brambley-SRC)
W81-03318

SIMPLE STATISTICS FOR INTERPRETING ENVIRONMENTAL DATA,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 5D.
W81-03392

8. ENGINEERING WORKS

8A. Structures

PARTICLE SIZE, STRUCTURE, AND MINERALOGY OF CLOGGED DRAIN OPENINGS,
Nevada Univ., Reno. Div. of Soil and Water Science.
F. F. Peterson.
In: Factors Influencing Water and Particle Movement into Drains, Science and Education Administration, Oakland, California, Agricultural Research Results ARR-W-8, June, 1979, p 1-18. 5 Fig, 3 Tab, 1 Ref.

Descriptors: *Tile drains, *Drainage systems, *Particle size, *Mineralogy, *Clogging, Iron oxides, Construction joints, Sand, Silt, Infiltration, Loam.

Extensive drainage tile joint clogging has occurred in the Coachella Valley, California. Several joint-clogging materials have been hypothesized, including calcium carbonate, iron and manganese hydrous oxide deposits, and the plugging by infiltration and lodgment of progressively smaller sand grains. The hypothesis of sand infiltration plugging has been particularly difficult to investigate because plugged tile lines have to be opened in a pit dug into unstable soil below the water table. Any purely mechanical bridging and fitting of sand grains as a dense pack in the joint would be destroyed when the joint was separated for inspection. A method was developed for obtaining plugged tile joints in undisturbed state, and the plastic impregnation and sectioning of joints. Undisturbed tongue-and-lip joints from two inoperative concrete drainage tile lines in a low-clay micaceous Mecca soil of the Coachella Valley were examined in petrographic thin and thick sections for identification of joint-plugging materials. The joint outer zones of both were plugged with size-graded, finer sand and silt like those in the Mecca soil. One joint was also plugged with hydrated iron oxide gel. The filter envelope material used locally is contaminated with finer sands and silt, which also could be transported and deposited in the tile joints. Drainage-line design to prevent joint plugging in this situation should reflect the character of the soil. (Moore-SRC)
W81-03294

LABORATORY EVALUATION OF FACTORS INFLUENCING PARTICLE MOVEMENT INTO DRAINS,
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
G. H. Cannell, and L. V. Weeks.
In: Factors Influencing Water and Particle Movement into Drains, Science and Education Administration, Oakland, California, Agricultural Research Results ARR-W-8, June, 1979, p 19-31. 4 Fig, 6 Tab, 1 Ref.

Descriptors: *Tile drains, *Drainage systems, *Soil properties, *Hydraulic models, Model studies, Particle size, Clogging, Groundwater movement, Gravel packing.

In the Coachella Valley of southern California, the discharge from a large number of drain lines is much less than the design capacity. Standing water can be measured above affected drain lines during, and for prolonged periods after, water application. The general unstructured characteristics of coarse-textured material dominate the soil profile where the drains are placed, necessitating envelope materials in drain placement. Drainage model studies were conducted in the laboratory to study factors related to the behavior of drain envelope material under these conditions. Laboratory tests conducted on different base and evelope materials in two types of models have shown that fine soil particles do move in and through drain envelopes. If envelope pores are large, particles can move easily. Photographs of drainage openings show that plugging of the actual gap was not the cause of decreased drain discharge. The problem seems to occur when fine particles move within the envelope material, clogging and reducing the area of large pores. (Moore-SRC)
W81-03295

EFFECTIVENESS OF VARIOUS SAND AND GRAVEL SEPARATES FOR DRAIN ENVELOPES,
California Univ., Davis.
J. N. Luthin.
In: Factors Influencing Water and Particle Movement into Drains, Science and Education Administration, Oakland, California, Agricultural Research Results ARR-W-8, June, 1979, p 33-42. 1 Fig, 4 Tab, 1 Ref.

Descriptors: *Gravel packing, *Sand, *Subsurface drains, *Flow rates, *Clogging, Silt, Drains, Particle size, Design criteria, Tile drains, Permeability coefficient.

Some design criteria used for drain envelopes were developed for gravel packs around wells. Although flow around a well is similar to that around a drain, flow is much faster near a well, and the lower amount of gravel required for a well allows the use of a more expensive type of gravel envelope. Various envelope materials were tested under conditions simulating those in the vicinity of a subsurface drain line, such as a tile drain. It was found that single-sized separates, such as pea gravel, are not effective as envelope in preventing fine sands and silts from moving into drains. They may serve as good bedding material, and they may improve flow into the drains by increasing conductivity adjacent to the drain. Material smaller than No. 60 should be excluded from the envelope since material that small will move into the drain line. A good envelope should contain appreciable amounts of No. 20 sand and some No. 40 and No. 10. Envelope effectiveness is decreased by the larger-size fraction of gravel. (Moore-SRC)
W81-03296

HYDRAULIC GRADIENTS IN ENVELOPE MATERIALS,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
L. S. Willardson.
In: Factors Influencing Water and Particle Movement into Drains, Science and Education Administration, Oakland, California, Agricultural Research Results ARR-W-8, June, 1979, p 65-70. 2 Fig, 4 Tab, 1 Ref.

Descriptors: *Head loss, *Particle size, *Subsurface drains, *Hydraulic gradient, Model studies, Hydraulic models, Flow rate, Permeability coefficient, Drains.

Hydraulic conductivity and hydraulic gradients in drain evelope materials were measured in the laboratory with permeameters 5.1 cm in diameter and 20.3 cm long. Piezometer taps were located around the wall of the permeameter at four circumferential positions. Tests were made for a range of hydraulic gradients for each material. The envelope material used was typical for drains in the Imperial Valley of California. For graded materials or for finer single size envelope materials, hydraulic gradients up to 10.0 do not appear to result in appreciably greater head losses. To determine the magnitude of head losses caused by placement of envelope materials next to orifices, four orifice-plate opening sizes were used with three sizes of envelope material. Reductions in flow tended to be smallest for the smaller orifices and larger material. The reductions were the greatest where the particles were almost the same size as the orifices. Placement of envelope material adjacent to drains will improve the overall hydraulic performance of the drain. The envelope material will bridge drain openings if the particles are larger than one-third the diameter of an equivalent circular opening. A slot has the same effective size as a circular hole with a diameter three times the narrow dimensions of the slot. Coarse materials adjacent to drain openings may develope non-Darcy flow at gradients greater than 1.0. (Moore-SRC)
W81-03298

Group 8A—Structures

IMPROVE I-I/SSES ACCURACY AND CUT COSTS,
E. L. Tharp, and L. P. Lawson.
Water and Wastes Engineering, Vol 17, No 7, p 29, 30, 54, July, 1980. 2 Fig, 2 Tab.

Descriptors: *Sewer systems, *Sewer infiltration, *Monitoring, Flow measurement, Rainfall infiltration, Repairing, Costs, Sewerage, Maintenance costs, Operation costs.

Two-stage flow monitoring can be used to locate infiltration-inflow sources at a reasonable cost. Eighty percent of all infiltration-inflow problems occur in only 20% of the sewer system. It is possible to locate through flow monitoring the small portion of the collection system that is causing most of the difficulties. This analysis involves monitoring the wastewater flow before, during, and after a rainfall. Successful rehabilitation of only those areas identified by a Sewer System Evaluation Survey results in both an increase in sewer treatment plant efficiency and a reduction in operating and maintenance costs. Rehabilitation is more economical when limited to the smallest possible areas of the system. One approach monitors about every 20,000 feet for the elimination of sound areas, and then monitors about every 4,000 feet in areas known to contain problems. Gross flow monitoring eliminates 30-70% of the sewer, thus intensive monitoring is needed in only about 40%. This approach costs about half what the conventional approach costs. (Small-FRC)
W81-03531

THE WOODHEAD RESERVOIR, CAPE TOWN,
Cape Town City Engineer's Dept. (South Africa).
D. Hodson.
Civil Engineer of South Africa, Vol 22, No 11, p 349, 351, November, 1980. 2 Fig.

Descriptors: *Reservoirs, *Engineering structures, Bodies of water, History, Impoundments, Surface water, Civil engineering, Dams, Gravity dams, *Cape Town, South Africa.

The history of development of an adequate water management scheme for the area of Cape Town, South Africa is reviewed. By the year 1872, water shortages in the area were common. Until this time Cape Town obtained the whole of its supply from springs which rise on the northern slopes of Table Mountain above the town. A plan was suggested in 1858 to tunnel through the Twelve Apostles range of mountains and tap the largest single catchment area draining into what was then called the Backwater Stream, which ran through Upper and Lower Disa Gorge, down Orange Kloof, and out into the sea at Hout Bay. However, action was delayed and the initial parts of the plan did not become operative until 1891. The Woodhead Reservoir was finally completed. The major shortcoming of early public works such as this dam and several others in the area was a shortsightedness on the part of those involved with financial planning. The Woodhead dam is one of the most impressive in Southern Africa. The middle part is arched in plan on a 78 m upstream radius and is 49 m long. The relatively shallow flanks make a total length of 248 m. The base width is 19 m or half the height, not including the 6 m depth below stream bed to the lowest foundation. The Woodhead Reservoir, together with four others on Table Mountain and the associated aqueducts and treatment plants, remain an invaluable asset affording reliable gravity supplies to high level zones on both sides of the mountain. (Baker-FRC)
W81-03534

THE SAN DIEGO-WEST POINT LOMA 114-INCH INTERCEPTOR FAILURE,
Hydro Conduit Corp., Corona, CA.
K. K. Kienow.
Water and Sewage Works, Vol 127, No 5, p 44-45, 70, 72, May, 1980. 2 Fig, 8 Ref.

Descriptors: *Corrosion, *Interceptor sewers, Sewers, Hydrogen sulfide, Sulfides, *Corrosion control, Concrete pipes, Reinforced concrete.

Extensive sulfide attack has damaged the 8,000 ft long, 114 in diameter reinforced concrete pipe installed in 1963 for the city of San Diego's wastewater system. Currently rehabilitation of the pipe is scheduled. With the extensive pumping involved in the system, the designers recognized that sulfide generation in the 87 in diameter force main and corrosion potential throughout the gravity sections would be severe. Three types of pipe protection systems were used: sacrificial concrete with granitic aggregate, sacrificial concrete with limestone aggregate, and PVC-lined RCP (reinforced concrete pipe) with integral locking lugs cast into the concrete. In February of 1965 it was found that the 114 in diameter pipe was undergoing severe hydrogen sulfide attack. In May of 1969 it was recommended that suitable sulfide control measures be instituted to prevent significant additional corrosion. In October 1978 it was reported after extensive study that the granitic aggregate sacrificial concrete used in the Metro interceptor facilities had not provided sufficient protection. Structural strength was below acceptable levels. The flow capacity of the existing pipeline was reported to be less than designed due to a change made in the grade of the interceptor during its construction. The flat grades, irregular profile and lack of effective diffusion of the injected air were blamed for the lack of sufficient countermeasure efforts. (Baker-FRC)
W81-03558

8B. Hydraulics

VELOCITY DISTRIBUTION IN OPEN CHANNELS: ANALYSIS BY THE FINITE ELEMENT METHOD,
Cape Town Univ. (South Africa).
E. P. Querner, and W. S. Doyle.
Civil Engineer of South Africa, Vol 22, No 11, p 327, 329, 331, 333, 335, November, 1980. 5 Fig, 2 Tab, 15 Ref.

Descriptors: *Velocity, *Channel flow, *Turbulent flow, *Finite element method, Open channels, Boundary layers, Water conveyance, Mathematical studies, Hydraulics, Flow, Numerical analysis.

The finite element method is used to determine the velocity distribution in open channels of arbitrary cross section under turbulent flow conditions. This method avoids the difficulties of the finite difference method when boundaries are not amenable to the necessary finer spacing of grid points near the wall. The finite element method situates the boundary at a prescribed distance from the wall. The turbulent flow condition has been modeled as a general equation of motion. The eddy velocity is used to account for the effect of turbulence on the mean flow. The velocity distribution has been determined for different channel cross sections using triangular finite elements. Comparison of model results with field measurements in parabolic, triangular, and rectangular sections shows general agreement in velocities except for magnitude and position of maximum velocity. There is also a marked disparity of calculated and measured results in the shallow region of channel cross sections. (Cassar-FRC)
W81-03427

8C. Hydraulic Machinery

APPARATUS FOR CONTROLLING LIQUID LEVEL IN A RESERVOIR,
Cypro, Inc., Hampstead, MD. (Assignee).
W. S. Pearson.
U.S. Patent No 4,207,030, 12 p, 8 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 995, No 2, p 571, June 10, 1980.

Descriptors: *Patents, *Water levels, *Reservoirs, Water level fluctions, Pressure head, Pumps, Control systems, Balance beams.

A balance beam adjustable for a desired liquid level in a reservoir is under the control of a device responsive to pressure head in a main leading from, and reflecting the liquid level in, the reservoir, the beam being in charge of a pump control for one or more pumps for activating the pumps when required when the liquid level drops in the reservoir, where by to substantially maintain the liquid level. A timer-operated anti-stagnation or anti-icing control device is provided in association with the beam. (Sinha-OEIS)
W81-03370

8D. Soil Mechanics

ORGANIC LEACHATE EFFECTS ON THE PERMEABILITY OF CLAY LINERS,
Texas Agricultural Experiment Station, College Station. Dept. of Soil and Crop Sciences.
D. Anderson, and K. W. Brown.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche.
In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania. Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 119-130. 11 Fig, 3 Tab, 9 Ref.

Descriptors: *Leachates, *Clays, *Organic compounds, *Permeability, *Linings, Industrial wastes, Leaching, Permeameters, Testing procedures, Molecular structure, Waste disposal.

Permeability remains the primary criterion for evaluating the suitability of clay soils for the lining of hazardous waste landfills. It is estimated that 60% of the solutes in liquid hazardous industrial wastes are organic chemicals and 40% are inorganic, yet there is little information on the effect of organic chemicals on clay liners. Primary leachate is formed from the flowable constituents of the waste, and secondary leachate results from the solution of materials in percolating water. A method has been developed and is presented in detail, of determining the effects of leachates on clay liners, using multiple permeameters. Two wastes, two leachates, their replicates and controls can be tested simultaneously. Large permeability increases were observed in two smectite clays after the soils were permeated with neutral-polar (acetone, ethylene glycol), neutral-nonpolar (heptane, xylene), and basic organic (aniline) fluids. The acidic fluid (acetic acid) decreased the permeability of the same clays although soil piping occurred to a significant degree. The permeability of clay liners to be used in a landfill must be tested before use with leachates generated by the disposal waste. (Brambley-SRC)
W81-03345

8F. Concrete

ASBESTOS-CEMENT PIPE IS NO DANGER IN CONNECTICUT,
Yale Univ., New Haven, CT. School of Medicine.
J. W. Meigs, S. D. Walter, J. F. Heston, J. R. Millette, and G. F. Craun.
Water and Sewage Works, Vol 127, No 6, p 66, 68, 93, June, 1980. 1 Tab, 15 Ref.

Descriptors: *Pipes, *Asbestos, *Human diseases, Diseases, Carcinogens, Public health, Epidemiology, *Distribution systems.

Asbestos/cement (A/C) pipe has been installed in many Connecticut townships within the past 30 years to carry drinking water. Counts of asbestos fibers in water systems have rarely been greater than one million fibers per liter. More than 40 years of cancer incidence data by town of patient residence were made available to the Connecticut Cancer Epidemiology Unit from the Connecticut Tumor Registry. For 82 towns in which public water supplies were delivered either partly or wholly through A/C pipe, crysotile asbestos fibers per liter were measured at the source and at the tap. None had counts above 100,000 fibers/liter in source waters. A positive association between length of pipe and kidney cancer was found for data from 1955-1964, but no significant kidney cancer associations were found with A/C pipe in 1975. Similar results were found for other cancer sites, allowing the conclusion that there is no evidence calling for changing current water distribu-

tion policies in Connecticut water supplies being delivered by A/C pipe. (Baker-FRC)
W81-03537

THE SAN DIEGO-WEST POINT LOMA 114-INCH INTERCEPTOR FAILURE,
Hydro Conduit Corp., Corona, CA.
For primary bibliographic entry see Field 8A.
W81-03558

8G. Materials

TESTS OF SPUN-BONDED NYLON FABRIC AS AN ENVELOPE MATERIAL,
California Univ., Davis. Dept. of Land, Air and Water Resources.
A. Orhun, and J. N. Luthin.
In: Factors Influencing Water and Particle Movement into Drains, Science and Education Administration, Oakland, California, Agricultural Research Results ARR-W-8, June, 1979, p 43-64. 5 Fig, 8 Tab, 1 Ref.

Descriptors: *Subsurface drains, *Pipes, *Flow rates, *Particulate matter, Sand, Hydraulic gradient, Model studies, Filters, Drains, Hydraulic models, Plastics, Nylon-screen covering.

A common synthetic envelope material for perforated plastic drain pipe is a nylon-screen covering. The nylon screen is a random-fiber unwoven material designed to prevent sand particles from entering the drain. The holes in the screen are large enough to permit fines to pass. Experiments on the effectiveness of spun-bonded nylon fabric as an envelope material were carried out in a tank filled with Oso Flaco Dune Sand. The soil surface was about 5 ft 10 inches above the bottom of the tank. Four experiments with three different maximum water table heights were carried out. The measured flow rates are compared with flow rates for a completely perforated pipe having the same diameter, measured in the same tank. The measured water table heights for almost all of the experiments are lower than those reported for a drain diameter of 10 cm. The fiberglass filter was satisfactory in general, although a small amount of sand filtered in during the experiment which had the highest exit gradient. (Moore-SRC)
W81-03297

MEMBRANE LINER SYSTEMS FOR HAZARDOUS WASTE LANDFILLS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
R. C. Gunkel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 131-139. 15 Fig, 1 Tab.

Descriptors: *Linings, *Landfills, *Waste disposal, *Membranes, *Construction, Protection, Soil types, Damage, Gravel, Sand, Silt.

An economical method is required to protect flexible membranes from damage during the construction of landfills. A test section containing 12 test items was constructed and subjected to three types of vehicle traffic (tracked, pneumatic-tired, and cleated). Four flexible membranes, six selected subgrades, three thicknesses of a sand protective layer, and bedding materials were investigated. The subgrades were 6 in. of crushed gravel, gravelly clayey sand, sand, gravelly sand, coarse gravel, and 6 in. of sandy silt over 6 in. of coarse gravel, and the sand protective layer was 6, 12 or 18 in. thick. The three vehicles produced similar amounts of damage to each membrane. Most of the punctures produced were from the subgrade in an upward direction. All membranes showed less damage on the sand and sandy silt subgrades than on the subgrades containing gravel. The extra 6 in. of bedding material reduced the number of punctures in the membranes. A fabric material placed below the membranes did not reduce the number of punctures. It is suggested that both a bedding and a protective cover are necessary to protect flexible membranes from puncture during the construction of landfills. (Brambley-SRC)
W81-03346

DURABILITY OF LINER MATERIALS FOR HAZARDOUS WASTE DISPOSAL FACILITIES,
Matrecon, Inc., Oakland, CA.
H. E. Haxo, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, PA., Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 140-156. 4 Fig, 9 Tab, 10 Ref. 68-03-2173.

Descriptors: *Linings, *Durability, *Hazardous materials, *Polymers, *Waste disposal, Organic compounds, Membranes, Physical properties, Tolerance, Resistance.

The results of several exposures of a variety of samples of soil, admix, sprayed-on, and polymeric membrane liners to a selected group of real hazardous wastes and three test fluids, i.e. distilled water, 5% aqueous solution of sodium chloride, and a saturated solution of tributyl phosphate are discussed. The exposures included the primary test of 12 liners in contact with 6 wastes for three years, immersion tests of 12 polymeric membranes in 9 wastes for up to 2.25 years, and roof exposure of polymeric membranes and wastes. The effects of the exposures vary greatly with liner materials and with wastes. The effect of minor amounts of organic constituents in a waste can have significant effects on liner materials on prolonged exposure. The degree of swelling of polymeric membranes in contact with a waste is a measure of the compatibility of the liner with the waste. The greater the swelling the less the compatibility. Swelling of a membrane results in the loss of physical properties such as tensile strength, elongation at break, and tear strength. Major factors in the swelling of a membrane in a given waste are its solubility parameter with respect to that of the waste, its degree of crosslinking and crystallinity, and the presence of water soluble constituents in the membrane compound. No single liner material in the test program appears to satisfy all of the requirements for all wastes. The complexity of the various waste streams requires that compatibility tests must be run to demonstrate the durability of the lining material under consideration with the waste which is to be impounded. Liners based on polymers with crystallinity appear to be more resistant to water and chemicals than the other polymeric materials.
W81-03347

INSTALLATION PRACTICES FOR LINERS,
Southwest Research Inst., San Antonio, TX.
D. W. Shultz, and M. P. Miklas, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173882, Price codes: A18 in paper copy, A01 in microfiche. In: Land Disposal: Hazardous Waste, Proceedings of the Seventh Annual Research Symposium, March 16-18, 1981, Philadelphia, Pennsylvania, Environmental Protection Agency Report, EPA-600/9-81-002b, March, 1981, p 157-167. 12 Fig, 1 Tab. R806645010.

Descriptors: *Linings, *Installation, *Land disposal, Municipal wastes, Asphalt, Wastewater lagoons, Bentonite, Polymers, Costs, Cost-benefit analysis.

The selection and installation of impervious liners is an important aspect of the construction of secure waste disposal sites on land. Subgrade preparation requirements and liner placement procedures for three different processes were observed at three installation sites. A municipal landfill has 12 in. of specially selected subgrade, after compaction, is sealed with 2 in. of road grade asphalt. A diked wastewater storage impoundment has a bentonite clay modified with a cross-linked polymer disked into the top 4 in. of the topsoil, on the base and sides of the impoundment. A small test evaporation pond has a polypropylene mat coated with a urethane asphalt material. A relative/subjective comparative ranking of the three liner systems suggests that the soil sealant has the best overall ease of installation. The ranking considers: weather limitations, crew experience, subgrade compaction, availability of materials and crew, quality control, and cost of materials and installation. (Brambley-SRC)
W81-03348

8I. Fisheries Engineering

TEST ORGANISM ACQUISITION AND CULTURING IN THE LAB,
Environmental Protection Agency, Chicago, IL. Central Regional Lab.
For primary bibliographic entry see Field 5A.
W81-03310

MATHEMATICAL MODELING OF THE DISTRIBUTION OF FISH EGGS FROM SPAWNING REGIONS OF A RIVER,
Stone and Webster Engineering Corp., Boston, MA.
G-T. Yeh, and C. F. Yeh.
Ecological Modelling, Vol 8, p 97-107, January, 1980. 6 Fig, 14 Ref.

Descriptors: *Fish eggs, *Aquatic drift, Mathematical models, *Cooling waters, Power plants, Movement, Model studies, Entrainment, Currents, Diffusion, Rivers.

The entrainment of ichthyoplankton in cooling water systems of powerplants has prompted research on the transport of fish eggs over a large geographical area. As part of this research, a deterministic mathematical model was formulated for predicting the distribution of fish eggs after they drift away from their original spawning area. The model is based on the conservation of numbers and incorporates the effects of egg settling, diffusion capability of the water body, and river boundaries and currents. A close form solution is readily obtained by suppressing egg-flux across river banks, or water surfaces or bottoms. The model was applied to three different source locations at three settling velocities to determine the effects of these parameters on the distributions. Reasonably good quantitative and qualitative results were obtained, but the verification and validation of the model has yet to be accomplished. It is expected that the present mathematical procedure will provide biological researchers with a quick and easy technique for predicting the location of fish eggs in a river. (Geiger-FRC)
W81-03401

ENTRAINMENT AND IMPINGEMENT AT COOLING WATER INTAKES,
Oak Ridge National Lab., TN. Ecological Sciences Information Center.
For primary bibliographic entry see Field 5C.
W81-03489

9. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

THE ROLE OF NORWEGIAN UNIVERSITIES IN MARINE POLLUTION RESEARCH,
Ministry of Environment, Oslo (Norway).
R. Lange.
Marine Pollution Bulletin, Vol 12, No 2, p 40-44, February, 1981. 6 Fig, 2 Ref.

Descriptors: *Marine environment, *Research priorities, *Universities, Marine resources, Water pollution effects, Water pollution control, *Norway.

The history of the administration of marine pollution research in Norwegian universities is reviewed, beginning with a 1930 publication from the Institute of Marine Biology, University of Oslo. Resources allocated for pollution studies have been increasing during the last decades. The Norwegian Marine Pollution Research and Monitoring Program (FOH) began in about 1976 and will run until 1984. Research is to be aimed directly at discovering the effect of oil on the marine environment, the monitoring of important bioresources, and the intensification of fundamental research relating to oceanographic and biological systems. One problem has been that university research institutes lack efficiency, while contracting institutes often lack the possibility of doing basic research. The nationwide Norwegian system operates satisfactorily in spite of some problems. While 60% of the research money goes to contracting institutes, some is invested in basic research. (Small-FRC)
W81-03497

9C. Research Facilities

STAFFING FOR WASTEWATER COLLECTION SYSTEMS,
Spalding, DeDecker and Associates, Inc., Madison Heights, MI.
J. B. Shah.
Water and Sewage Works, Vol 127, No 6, p 76, 78, 87-89, June, 1980. 1 Fig, 1 Tab, 1 Ref.

Descriptors: *Personnel, *Wastewater treatment, *Wastewater facilities, *Wastewater management, Engineering personnel, Professional personnel, Scientific personnel.

A few guidelines are presented for staff development and maintenance of pumping stations. The most important factor to consider is system size, which can be defined in terms of either the length of pipe or the amount of flow carried. Staffing requirements also depend on the system's age, condition, population served, and waste quality. Information is presented which was collected via survey technique in the tri-county area of Wayne, Oakland, and Macomb which surrounds Detroit, Michigan. The majority of the communities surveyed discharge their wastewater flows to the city of Detroit for final disposal. Manners in which staffing estimate curves can be employed are considered. Curves included in the paper can be used fairly accurately when staffing requirements for a new sewer system or an addition to an existing system are being prepared. Some adjustments for local conditions should be considered. (Baker-FRC)
W81-03559

10. SCIENTIFIC AND TECHNICAL INFORMATION

10A. Acquisition And Processing

AN ECOLOGICAL CHARACTERIZATION OF THE PACIFIC NORTHWEST COASTAL REGION, VOLUME FIVE, DATA SOURCE APPENDIX,
Ryckman, Edgerley, Tomlinson and Associates, Inc., Bellevue, WA.
For primary bibliographic entry see Field 6G.
W81-03326

10D. Specialized Information Center Services

EVALUATION OF THE EFFECTIVENESS OF AN INTEGRATED WATER RESOURCES RESEARCH INFORMATION TRANSFER PROGRAM,
Massachusetts Univ., Amherst.
R. Kreplick.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209124, Price codes: A07 in paper copy, A01 in microfiche. Completion Report, April, 1978. Massachusetts Water Resources Research Center, University of Massachusetts, Publication No 95. 124 p, 9 Tab, 49 Ref, 7 Append. OWRT-A-093-MASS(1).

Descriptors: *Information systems, *Information exchange, *Theoretical analysis, Evaluation, *Research priorities, Mathematical models, Priorities, Decision making, Libraries, Documentation, Economic aspects, Water resources development, Planning, Administrative decisions, Policy making, Data collections, Data transmission, Project planning.

An important aspect of the project was the development of a Methodology for Agency/Knowledge Bank Utilization, consisting of nine major processes and explicit steps within them. The methodology should prove useful to water resources research centers nationally, and other organizations. To provide the theoretical context within which the project was conducted, an extensive overview is presented of constructs in evaluation and change strategies, showing their relevancy to information transfer in the water resources field. Interrelationships discussed show how the focus and value emphasis of evaluation provided relevant data on successes/failures of a specific information transfer/change program, which can then be translated into decisions regarding that program. Major objectives of the integrated information transfer program were identified. Program evaluation criteria included assessment of the extent to which programmatic efforts met the Water Resources Research Center decision makers' priorities; a major priority was to provide the greatest user needs coverage for expenditures entailed. (Zielinski-IPA)
W81-03253

10F. Preparation Of Reviews

A REVIEW OF DISSOLVED GAS SUPERSATURATION LITERATURE,
Parametrix, Inc., Bellevue, WA.
For primary bibliographic entry see Field 5C.
W81-03476

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